WATER & SEWAGE WORKS

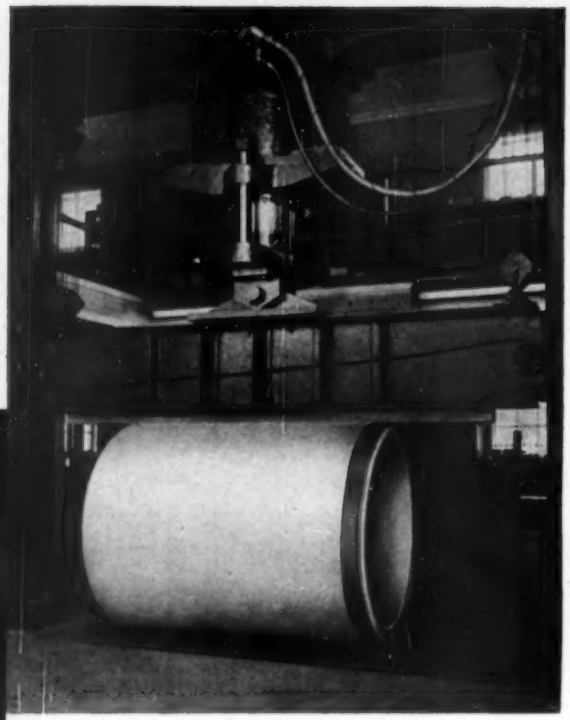
WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL

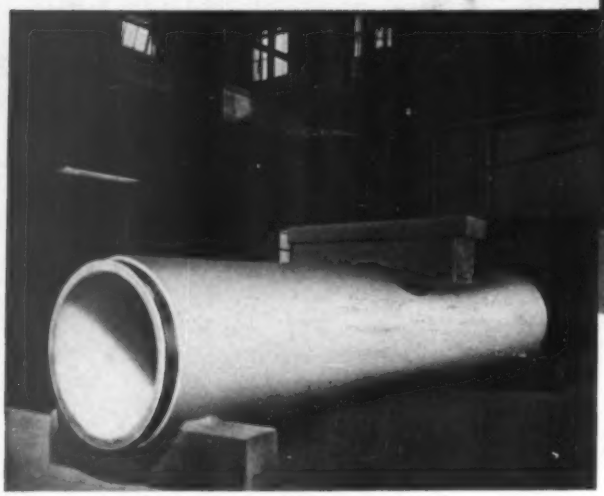
JANUARY 1954

NEW—Allentown's Zoning Filtration Plant

test after test assures the best

IN LOCK JOINT CONCRETE PRESSURE PIPE





▲ *Three edge bearing test in 300,000 pound capacity testing machine.*

◀ *Determining a pipe's beam strength in 300,000 pound capacity testing machine.*

Do you have conclusive proof of the fundamental characteristics of the pipe you intend using in your next water works project? Are you certain of its advantages? Do you recognize its limitations?

• • •

In Lock Joint's laboratory at Wharton, N. J. all guess work has been eliminated. Here, Lock Joint Pipes of all types and designs are tested to determine the exact extent of their ability to withstand back loads, beam loads and internal pressures. The most efficient modern equipment in the hands of highly trained personnel is used to give a tangible, practical demonstration of the high quality built into every type of Lock Joint Pipe.

• • •

These constant tests of our products are your assurance that, in its field, no finer pressure pipe than Lock Joint can be produced. Built in diameters from 16″ upward and designed for any pressure common to water works practice, these pipes will serve you unfailingly for generations.

SCOPE OF SERVICES—*Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains 16″ in diameter or larger, as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.*

LOCK JOINT PIPE COMPANY

Established 1905

P. O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich., Columbia, S. C.

SEWER & CULVERT PIPE PLANTS:

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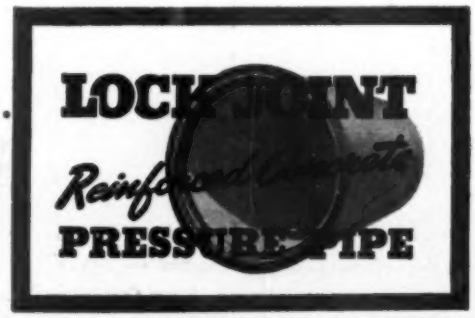

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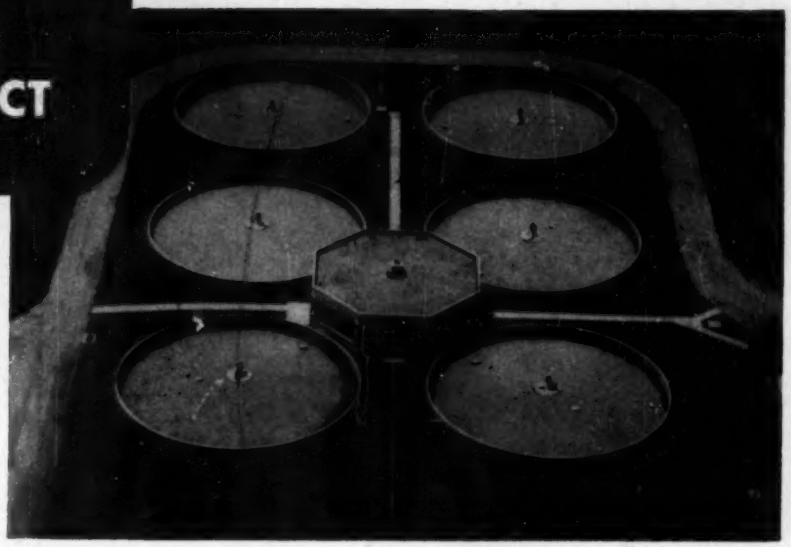
ACCELERATED SLUDGE DIGESTION NOW A FACT

*Exclusively through the Catalytic Reduction Process**



CRP

CATALYTIC REDUCTION PROCESS

The Catalytic Reduction Process completes biological sludge digestion in one-third to one-fourth of digester volume generally required. The Process accomplishes this by digesting at solids loading rates three to four times those being practiced. This accelerated digestion is simple and economical, using only the natural products of anaerobic decomposition.

Originating in 1946, the Process was developed, tested and verified over six years on both laboratory and pilot plant scale. The results obtained in the pilot plant operation have been proven in full scale plant operation at the Columbus, Ohio Sewage Treatment Works in 1952 and 1953.

The Catalytic Reduction Process applied to one 70′ tank at the Columbus Plant digested 3.38 times the quantity of sludge solids digested in a similar tank in parallel operation not using the Process. The tank operated under the Process produced a reduction of solids within established ranges, normal gas production and readily driable odorless sludge.

The Catalytic Reduction Process is now available for consideration by consulting engineers for application on plants under design and for plants requiring expansion. The Process when applied to overloaded digesters will provide sufficient capacity without additional tanks.

***The only proven Process for accelerating biological digestion. (Patents applied for.)*

The Catalytic Reduction Process is offered through the Catalytic Reduction Co., Inc. a subsidiary of the Chicago Pump Company.

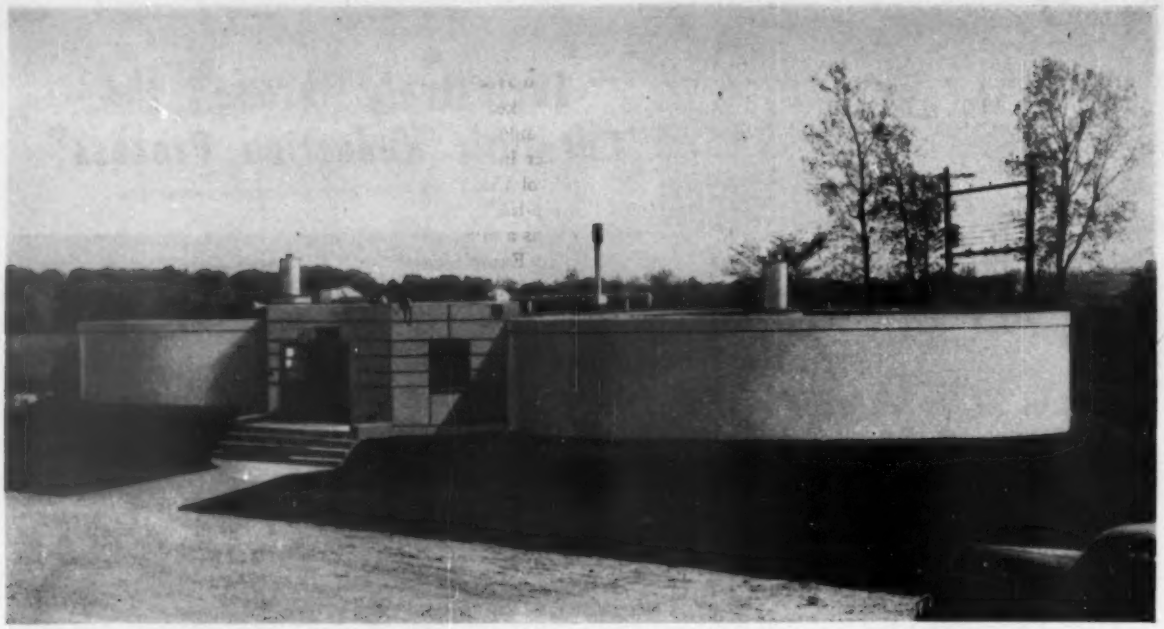
CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

622 DIVERSEY PARKWAY — **CHICAGO 14, ILLINOIS**

Flash Kleen, Saru-Feller, Plunger, Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.



At Fremont, Ohio . . .

Digestion is simplified and improved

WITH P. F. T. FLOATING COVERS

Serving a population of 20,000, Fremont's modern plant is designed for "Controlled Digestion" with two 45′ P.F.T. Floating Covers.

Plant procedures are *simplified* because additions and withdrawals can be made at times best suited to the overall operation. As sludge or digestor liquor is removed, the floating covers simply lower—equal volumes of liquid need not be added to maintain a fixed level. As sludge solids are added, the covers raise—equal amounts of digestor liquor need not be withdrawn. In this way, additions and withdrawals can be made *independently* at the operator's convenience.

P.F.T. Floating Covers also reduce costly breakdowns and repairs by eliminating all moving parts inside the digestor. Since no mechanical agitation is required, and heat is supplied from *external* heaters, all cleaning and maintenance operations take place *outside* the tank.

In addition, explosion hazards are greatly reduced because gas collected under the cover can escape only at the desired point. Even during additions and withdrawals, a constant pressure is maintained which prevents the entrance of atmospheric oxygen.

Both Floating Covers at Fremont contain a P.F.T. Supernatant Liquor Selector for automatic, continuous withdrawal of the best digestor liquor available. Additional P.F.T. equipment—housed in the convenient chamber between the tanks—includes: 2 Heater and Heat Exchanger Units (100,000 b.t.u. per hr.); 2 Supernatant Gauges; Gas Safety Equipment.

Complete information on request — Write for Bulletin 332.

Design of plant by / *Rollin F. MacDowell & Associates, Cleveland, Ohio*

P.F.T.

waste treatment equipment exclusively since 1893

PACIFIC FLUSH TANK CO.
4241 Ravenswood Avenue
Chicago 13, Illinois

NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

COMING ARTICLES

Developments and Trends in the Sewage and Wastes Fields—1953....*Mohlman*
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Pumps vs. Overhead Tanks in Filter Washing....*Angus*
The Magnetic Analyzer in Studies of Oxygen Uptake....*Hoover & Porges*
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Designing Water Mains and Service Lines in the Arctic....*Page*
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Improving Septic Tank Efficiency....*Baumann & Babbitt*
Life on Cleveland's Intake Crib in Lake Erie....*Holton*

"WATER WORKS PRACTICES" are discussed in a continuing series of articles by *"Doc" Symons.*

"SEWAGE WORKS PRACTICES" are discussed in a companion series of articles by *Prof. Don Bloodgood*

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EXECUTIVE OFFICE
185 North Wabash Ave., Chicago 1, Ill.
E. S. GILLETTE, President
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EDITORIAL OFFICE
155 E. 44th St., New York 17, N.Y.
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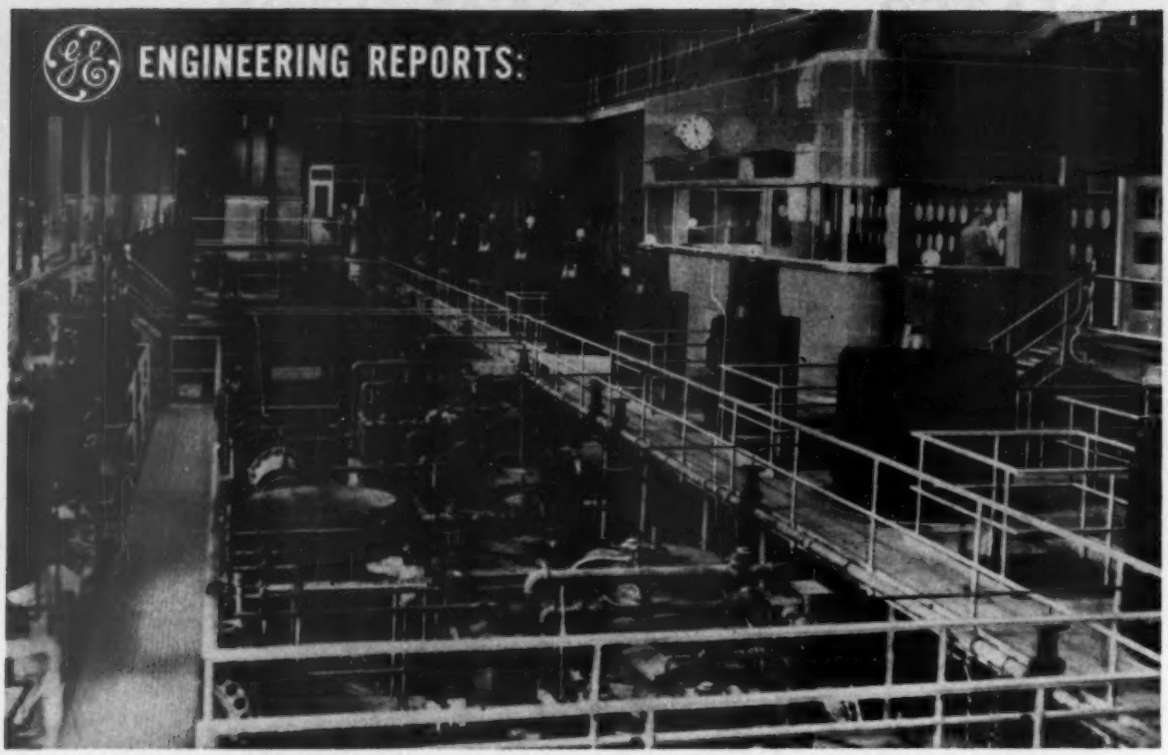
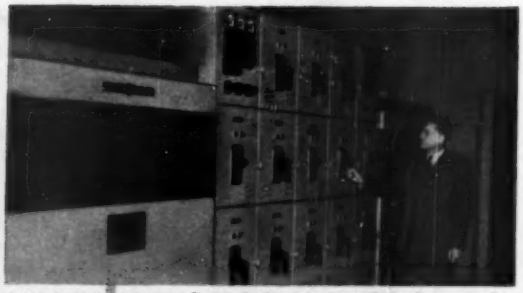
ENGINEERING REPORTS:



INCREASED WATER-PUMPING CAPACITY was recently provided at this fifty-year-old Bryant St. pumping station in Washington, D.C., with the help of G-E equipment. Station receives water at low pressure and elevates it to four distribution services. Main centrifugal pumps at right act as boosters in this operation. Operators' control room is shown behind pumps.

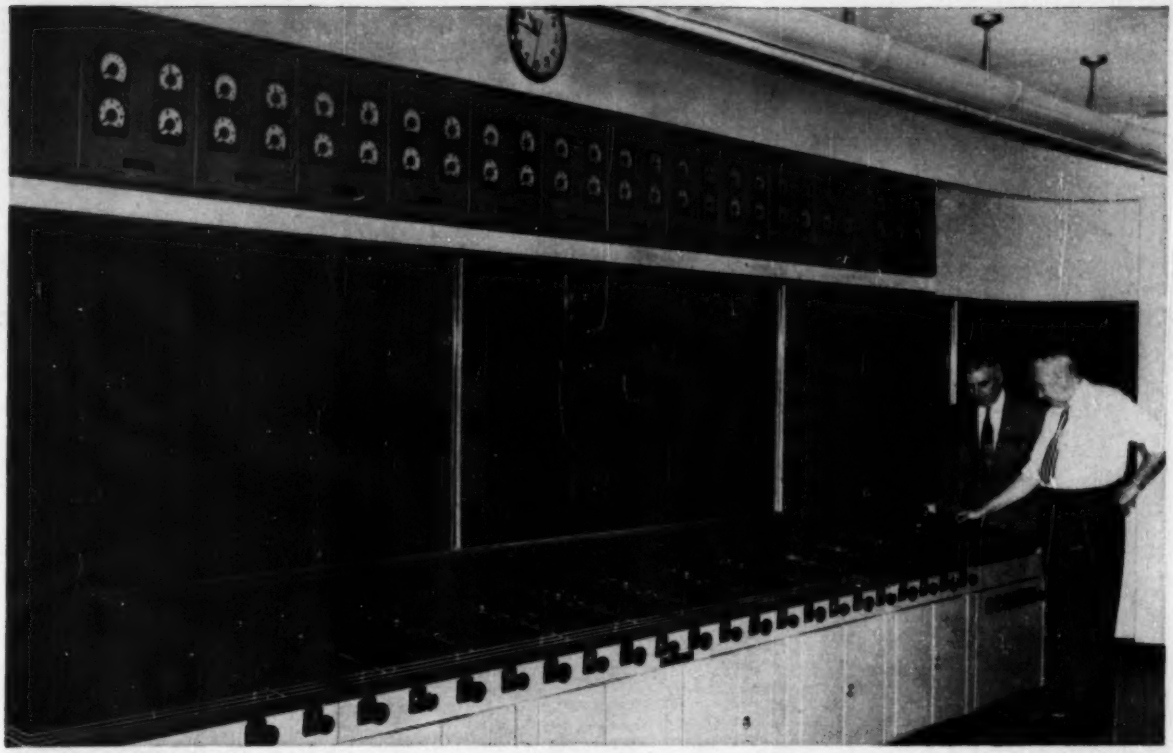
District of Columbia

RELIABLE OUTDOOR UNIT SUBSTATION steps down voltage for plant use to 2400 volts. G-E application engineers on this job worked closely with the consulting engineers, and with the Central Armature Works, electrical contractors.



SIMPLE OPERATION of this indoor unit substation can be provided by one man. Shown here are two G-E transformers supplying power for switchboard.

COMPLETE PROTECTION and control for pump motors is provided by this 2400-volt G-E metal-clad switchgear. In addition, these compact units provide circuit protection.



CENTRALIZED CONTROL of all plant operations can be provided by one man from this master control desk. Versatile SB-1 switches on panel are used to control pump motors and valves. Easy-to-read switchboard instruments above window indicate station electrical values. The entire twenty-two foot long desk is housed in a single enclosure.

expands water system

New G-E equipment at Bryant St. Station helps to *more than double* pumping capacity

In order to handle rapidly growing water requirements in the District of Columbia, a new modernization and expansion program was recently placed in operation at the Bryant St. Station. As a result, the station's water-pumping capacity has been boosted from 145 mgd to 310 mgd, providing increased capacity for Washington's growing needs.

Instrumental in the success of this expansion program was General Electric equipment and engineering assistance. To help provide a co-ordinated electrical system designed for this particular installation at minimum cost, G-E application engineers worked in close co-operation with the city's consultants.

This same kind of help can pay off for *your* community's water supply program, too. G-E application engineers are ready to work closely with you and your consultants to fit the right electrical equipment into a system tailored to your particular needs. Call in your G-E apparatus sales engineer *early in your planning stages,* where he can help you the most.

SHOW YOUR COMMUNITY THE IMPORTANCE OF ABUNDANT WATER

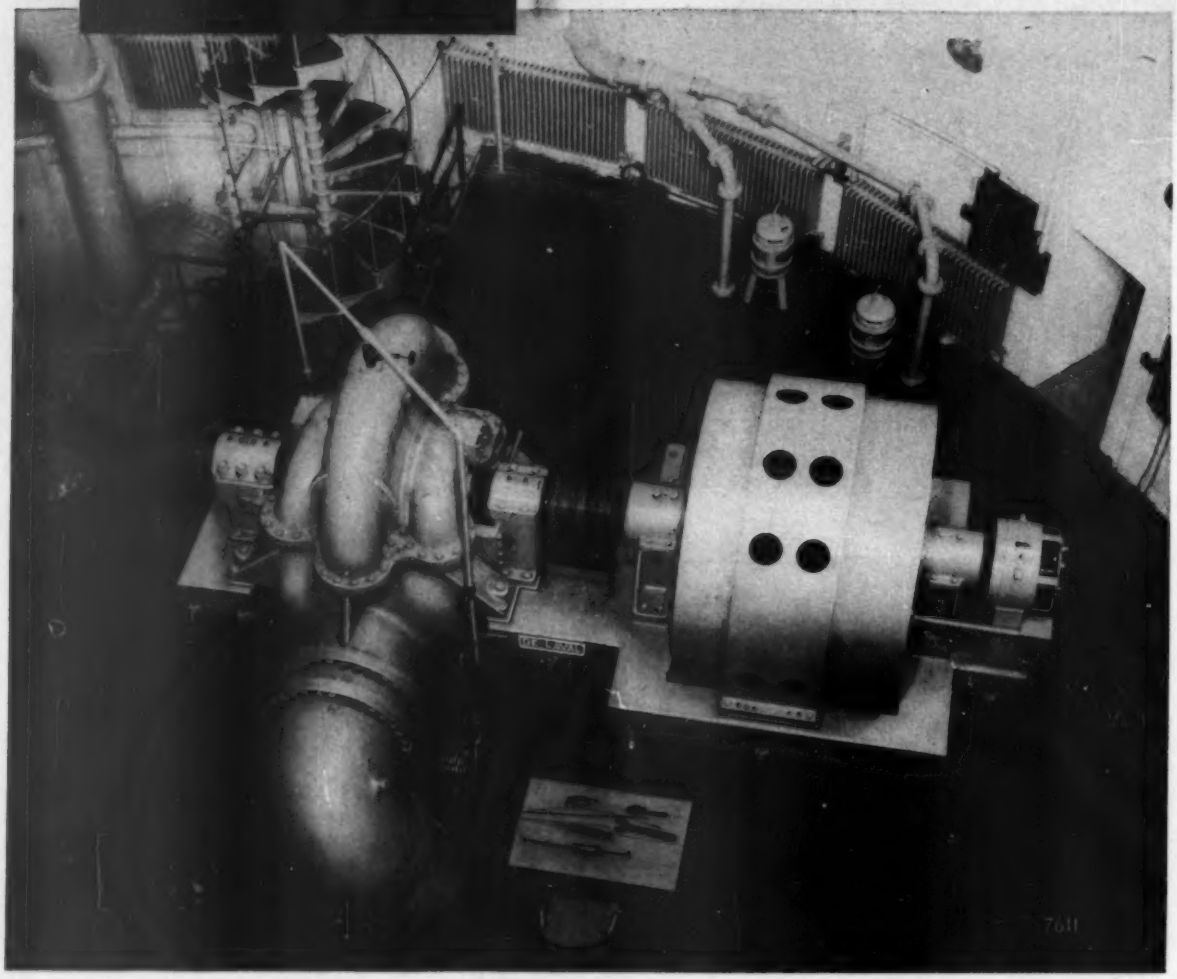
Stimulate interest for a water supply program by showing the new color movie "Pipeline to the Clouds." It's part of G.E.'s *More Power to America* Water Supply Program. For full information contact your local G-E Apparatus Sales Office or write on your letterhead for Bulletin GEA-5555 to General Electric Co., Apparatus Sales Div., Sect., 666-80, Schenectady, N. Y.

Engineered Electrical Systems for Waterworks

GENERAL ELECTRIC

DE LAVAL
CENTRIFUGAL
PUMPS

help Louisville meet increased water demand



This 60 mgd, 200 foot head centrifugal pump is one of a group of De Laval units that help meet Louisville's expanding water needs. Today, this growing community is served by De Laval pumps with a total capacity of 314 million gallons per day.

Progressive Louisville, like 80% of America's largest cities, depends on De Laval to meet its ever-increasing pumping demands efficiently and economically for years to come. Such proven dependability is the result of over 50 years experience in pump building, during which time De Laval has introduced numerous "firsts" in pump design.

De Laval Centrifugal Pumps are available in capacities ranging from 100 thousand gallons per day to more than 100 million gallons per day . . . all built for long, dependable service.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY
824 Nottingham Way, Trenton 2, New Jersey

DL 312

HORTON
ELEVATED WATER TANK

SURPASSES DEMAND

At Clearwater

In 1937, the Pinellas County Water System was formed to serve a string of islands from Belleair Beach to Pass-a-Grille, Florida. The system has been expanded many times since then but has never been able to keep up with the rapid population growth in the area.

At last, however, there is reason to believe the tide has turned. The addition to the system of a 200,000-gal. Horton ® elevated tank, 92 ft. 9 in. to bottom, at Clearwater has helped put the available water supply ahead of demand. The new tank, and a 500,000-gal. Horton tank, 90 ft. to bottom, installed in 1949, should keep the water supply ahead of population growth for some time. Consulting Engineers on the job were Briley, Wild and Associates of Daytona Beach, Florida.

If your municipal water system is being outdistanced by population growth, write our nearest office for estimates or quotations on a Horton elevated tank to suit your needs. There is no obligation on your part.

HORTON
WELDED STEEL
STORAGE TANKS

CHICAGO BRIDGE & IRON COMPANY
Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

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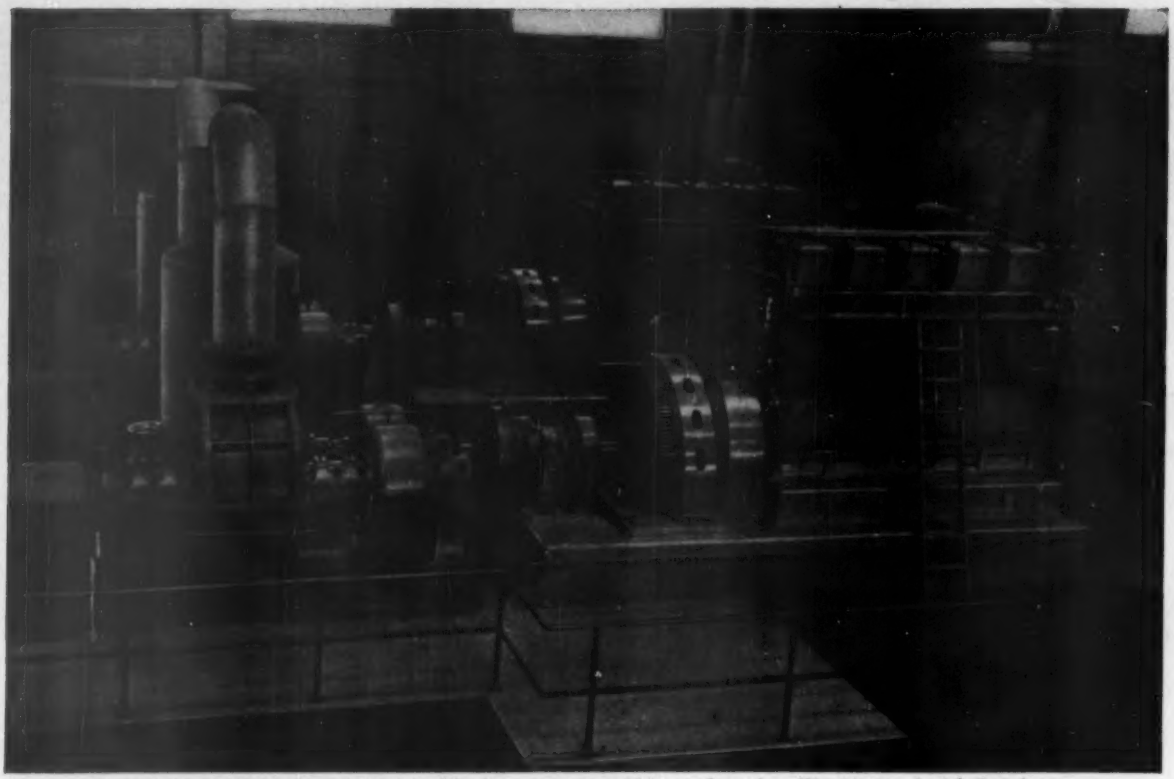
Detroit 26	1551 Lafayette Bldg.	San Francisco 4	1583—200 Bush St.
Havana	402 Abreu Bldg.	Seattle 1	1350 Henry Bldg.
Houston 2	2115 C. & I. Life Bldg.	Tulsa 3	1646 Hunt Bldg.



LITTLE FERRY STATION GETS POWER to drive its generators and blowers from these Worthington dual fuel engines.

Bergen County sewage system to serve 50 communities

System's power costs lowered by dual fuel engines using sewage gas

• The Little Ferry Treatment Plant was opened three years ago by the Bergen County Sewer Authority, and is now handling the raw sewage of ten communities. This plant is part of a system that will eventually serve about 50 New Jersey communities.

The Authority found that a large strategically-located plant equipped with dual fuel engines to generate the required power handles the entire job more efficiently and at a lower cost than a number of small plants.

Economical Worthington dual fuel engines used at the Little Ferry Station are designed to operate on either sewage gas or oil. They will maintain load in the event of a sudden emergency loss of gas supply by automatically switching to oil.

Get all the facts on Worthington dual fuel or gas engines. Write for complete information to Worthington Corporation, Engine Division, Section E.3.9, Buffalo, New York. E.3.9

WORTHINGTON

Economical Continuous Power—*Diesels, Oil and Dual Fuel, and Spark-Ignition Gas Engines, from 190 to 2100 bhp.*

LOW COST STORAGE
IN THE
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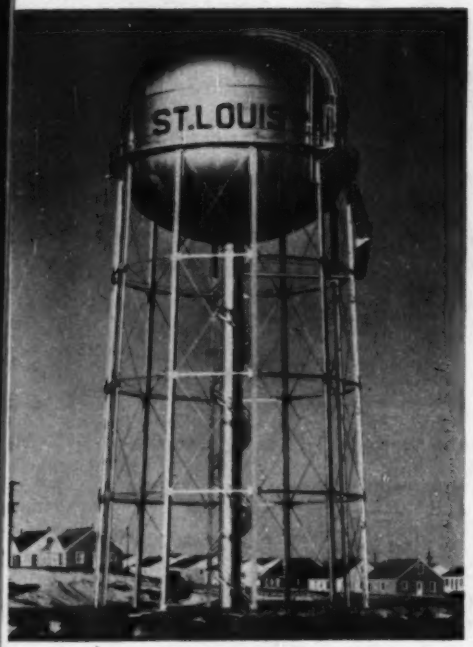
RANGE

PITTSBURGH-DES MOINES

DOUBLE-ELLIPSOIDAL

Elevated Steel Tanks



ST. LOUIS PARK, MINNESOTA
Diameter 65 ft.
Head range 48 ft. 5 ins.
H-column tower, 106 ft.

SANDUSKY, OHIO
Diameter 68 ft.
Head range 42 ft.
H-column tower, 81 ft.

AMARILLO, TEXAS
Diameter 68 ft.
Head range 42 ft.
Tubular column tower, 114 ft.

Write for this well-illustrated, comprehensive Catalog of the complete range of P-DM Elevated Steel Tanks, without obligation.

The intrinsic design economy of our famous Double Ellipsoidal Elevated Steel Tank makes this type particularly attractive where low cost with good appearance is a major consideration. Clean cut lines without ornamentation enable savings in construction that are reflected in the purchase price. Fine, simple proportions result in a handsome structure for the community. Let us give you the details on our Double Ellipsoidal and other elevated tank types in a personal meeting, at your convenience.

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IT'S DARLING'S NEW

B-50-B

Patent Pending

FIRE HYDRANT

...What a difference!

YES, what a *difference!* That's the word that's going around about the new and unique B-50-B—rated the most important advance in fire hydrant design in 50 years.

First, note that the B-50-B is *ball bearing* operated. Opening and closing takes less than half the usual wrench torque. *Smoother, faster, easier* operation every time!

Next, see how the B-50-B design uses "O" ring seals. No need for a stuffing box. It's a packless, *dry-top* hydrant. And it saves plenty of time and trouble! Does away with bothersome packing gland adjustment as well as the usual lubrication and maintenance of packing. Moreover, this "O" ring arrangement not only prevents the loss of thread and bearing lubricant, but never lets a drop of water reach the operating threads. Just add up *these* advantages!

As in any Darling hydrant, all inside working parts (main valve, main valve seat, drain valves and drain valve seats) can be removed through the top of the B-50-B for easy inspection and simplified maintenance. One 15-pound wrench does the trick, regardless of trench depth.

Before you decide on *any* hydrant, get *all* the facts on the Darling B-50-B.

Write for Bulletin No. 5007

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT 11, PA.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.

WATER is vital...

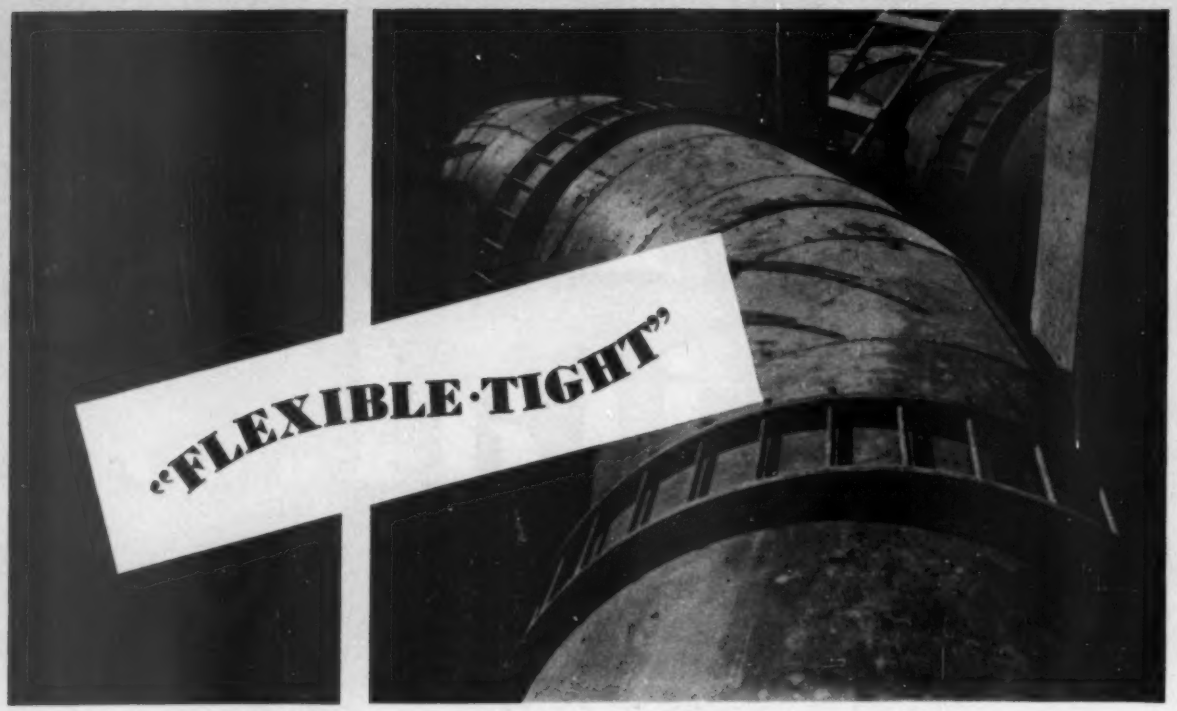
BADGER meters conserve it!

America now uses more than *7 billion gallons* of water per day . . . making conservation of supply almost as vital as the water itself. That's one reason Badger meters are used in thousands of communities throughout the nation. Badger meters measure water precisely . . . are made for every kind of water measuring job . . . provide an accurate check of water usage and water waste. And the Badger meter record of performance is unsurpassed . . . has caused waterworks men everywhere to agree — "It pays to install Badger meters!"

BADGER WATER METERS

BADGER METER MFG. CO., Milwaukee 45, Wisconsin

"Measuring the water of the world"



Joined for a lifetime...

These twin 67" air mains are a part of Sanitary District Sewage Works, in Chicago. Joined with Dresser Couplings to provide complete year-round dependability, they supply tremendous volumes of compressed air for Chicago aeration tanks. Expensive leaks could not be tolerated.

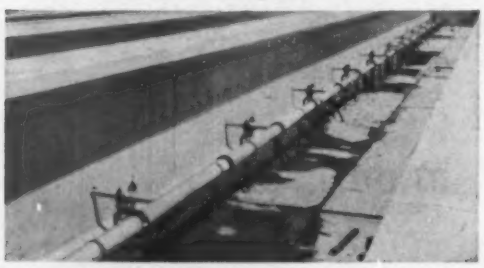
A fraction of a pound saved in air pressure would result in dollars saved in electric power costs. Dressers were selected for the job to assure that saving.

Dressers provide complete dependability because they stay airtight despite pipe movements common to all lines through the seasons. Specially compounded rubber gaskets in Dresser Couplings take up expansion-contraction stresses, vibration, earth movements, and stress from settling foundations.

And Dressers are factory built and tested . . . ready to install when you get them.

Installation is simple. Average time is 2 man-minutes per bolt, using only a wrench. You save time and labor costs, and eliminate the need for expensive repairs and maintenance, because Dressers stay "Flexible-Tight". In numerous installations they have been in service 50 years and more.

Write today for more information about Dresser applications on water, sewage, and industrial waste projects.



Dresser-Coupled air distribution lines to aeration tanks at the West Side Sewage Treatment Plant, in Chicago. Here again, sanitary engineers selected Dressers to assure airtight pipe joints through the entire distribution system. Simple, economical construction that can be depended on for years of trouble-free service.

DRESSER

COUPLINGS

Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, California. Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: Toronto, Ontario.

Hersey
Disc Water Meter
MODEL HD

Particularly designed for use in areas where non-freezing conditions exist

There are no substitutes for HERSEY WATER METERS

Hersey
Disc Water Meter
MODEL HF

Particularly designed for use in areas where freezing conditions may be encountered

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK PORTLAND, ORE. PHILADELPHIA ATLANTA DALLAS CHICAGO
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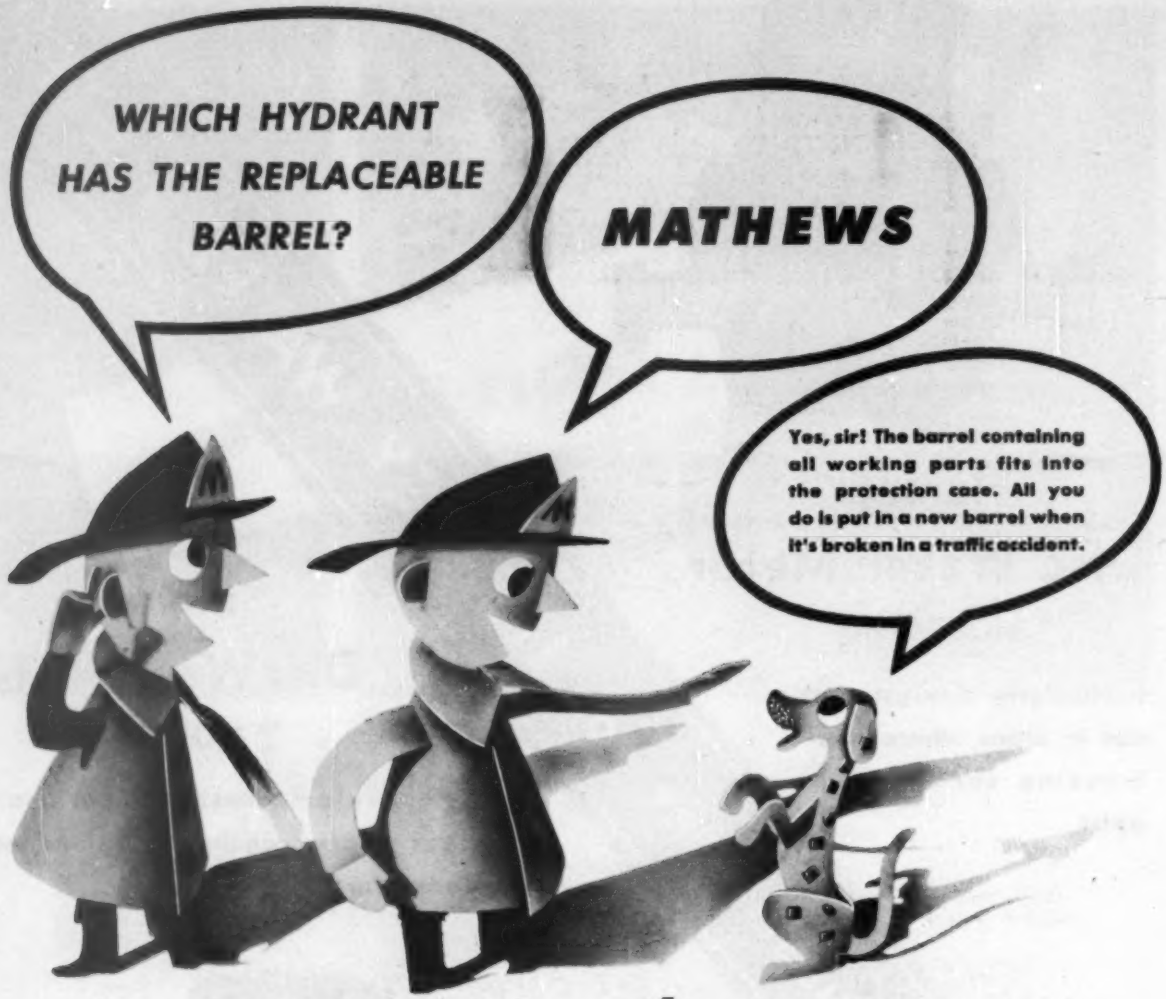

WHICH HYDRANT HAS THE REPLACEABLE BARREL?
MATHEWS
Yes, sir! The barrel containing all working parts fits into the protection case. All you do is put in a new barrel when it's broken in a traffic accident.

MATHEWS Means Fire Protection

LONG LIFE. Mathews Hydrants are protected at wear points by bronze bushings — corrosion and rust are thoroughly licked.

TROUBLE-FREE. The stuffing box plate, cast integral with the nozzle section, provides a positively leak-proof construction — water, sediment and ice cannot interfere with operating thread.

LOW-COST MAINTENANCE. Only one point requires lubrication — and that only during routine inspections.

REPLACEABILITY. A Mathews leveled in an accident can be replaced without excavating and in a jiffy. Community fire protection is interrupted only for a few minutes.

The Mathews includes every quality feature . . .

Compression type valve to prevent flooding • Head turns 360° simply by loosening bolts • Replaceable head • Nozzle sections easily changed • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • A modern barrel makes an old Mathews good as new • Mechanical-joint pipe connections as needed

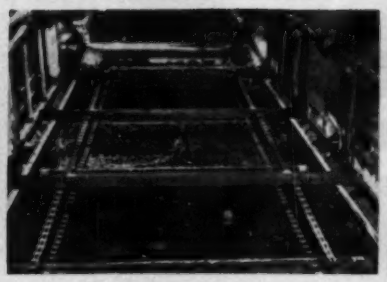
MATHEWS HYDRANTS

Made by R. D. Wood Company

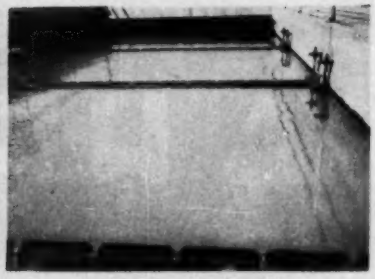
Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

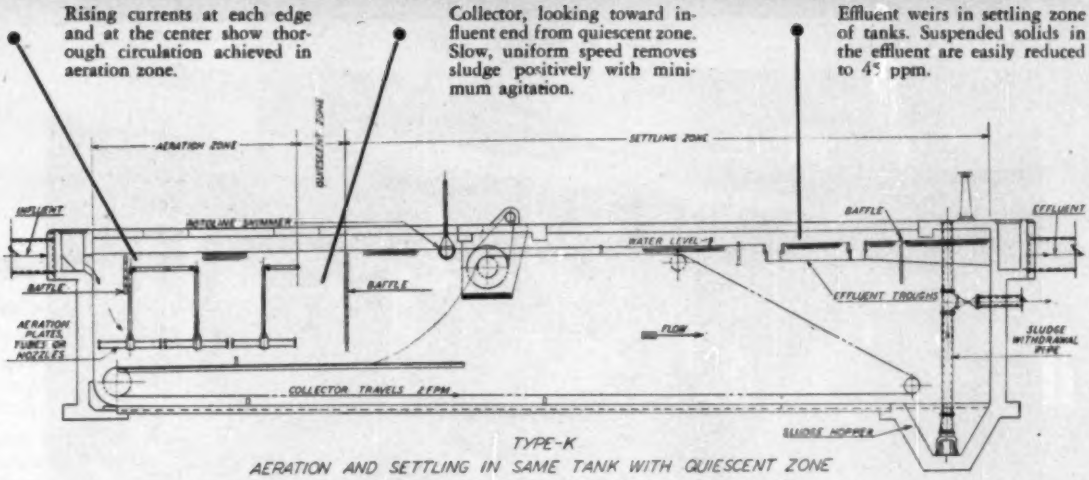
Rising currents at each edge and at the center show thorough circulation achieved in aeration zone.



Collector, looking toward influent end from quiescent zone. Slow, uniform speed removes sludge positively with minimum agitation.



Effluent weirs in settling zone of tanks. Suspended solids in the effluent are easily reduced to 45 ppm.



TYPE-K
AERATION AND SETTLING IN SAME TANK WITH QUIESCENT ZONE AFTER AERATION AND SLUDGE HOPPER AT EFFLUENT END

NOW! More effective, lower cost pre-aeration of sewage or waste

New LINK-BELT system combines pre-aeration and settling in a single tank

NOT only does the new Link-Belt pre-aeration system cut construction costs by eliminating separate tanks and their connecting piping — it also improves settling tank efficiencies. Violent aeration to prevent settling of heavy solids in aeration zone is unnecessary because they're collected along with the sludge in the settling zone. This, of course, ends the messy job of draining and cleaning the aeration tank manually.

Using only the correct volume of air produces a more gentle agitation. This increases flocculation . . . helps release more entrained gases . . . improves suspended solids settling rate . . . steps up B.O.D. removal. Even when chemicals are added to the sewage, proper mixing rate for maximum flocculation can be used. Sedimentation in aeration zone will not be a problem.

What's more, separated grease is removed immediately in the settling zone by the skimming action of the sludge collector. It is not re-mixed with the sewage in passing from the aeration zone to the settling zone.

For complete information on pre-aeration and other efficient equipment in the broad Link-Belt line, call the Link-Belt office near you. An experienced sanitary engineer — working with you, your chemists and consultants — will help you get the finest in modern sewage, water or industrial waste treatment equipment. 13,342

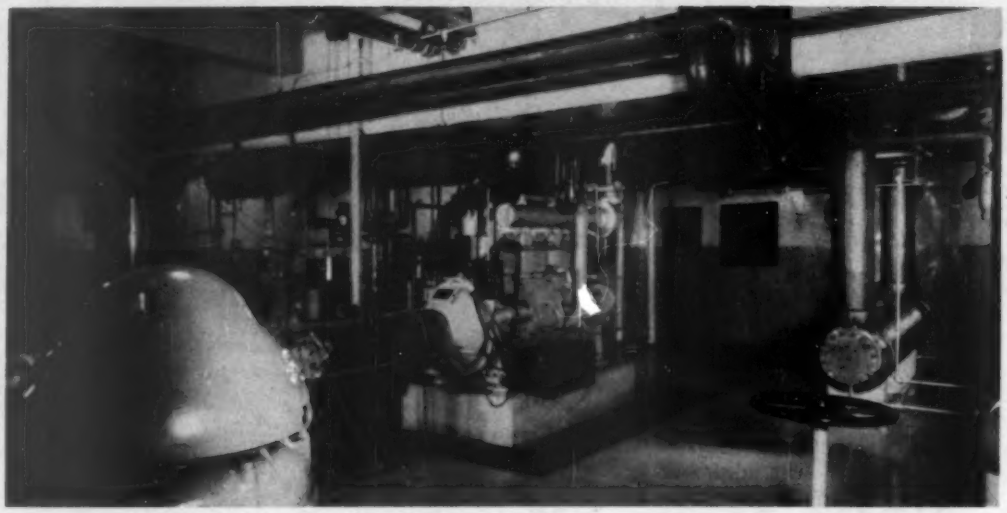
LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle; Scarboro, Toronto and Elmira, Ont. (Canada); Springs (South Africa); Sydney (Australia). Sales Offices in Principal Cities.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

HERESITE

REG. U. S. PAT. OFF.



The above view shows an Engine Room completely coated with the HERESITE VR-500 Series Air Drying Coatings. After 5 years the coated surfaces are still in good condition.

Reports from the same plant show that HERESITE VR-500 Series Air Drying Coatings have been applied to the cast concrete ceiling in the Clarifier Room and after 9 years of service no recoating is necessary. Also, successfully coated are the Detritor Room, Pump Room and all Pipe Gallerys.

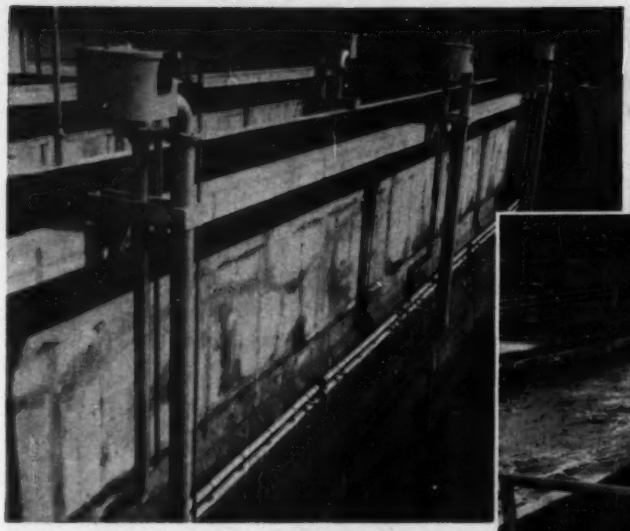
HERESITE VR-500 Series Air Drying Coatings offer complete resistance to moisture, mild acids and alkalis. No special equipment is necessary for application.

HERESITE AR-900 Series chlorinated rubber Air Drying Coatings are especially suited for chlorine and hypochlorite exposure.

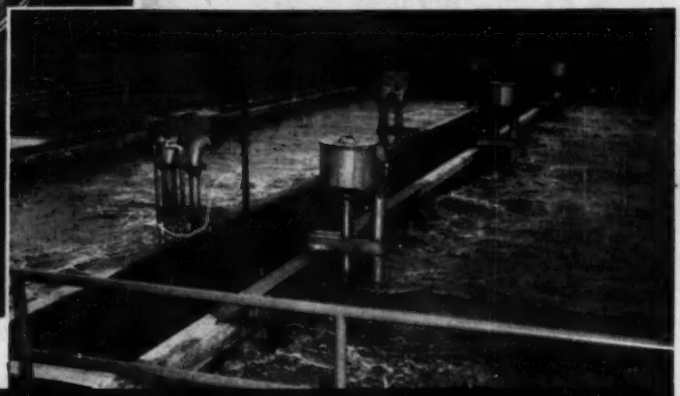
HERESITE AD-600 Series Coatings possess excellent resistance to caustic alkalis requiring only evaporation of the solvent to form a tough tenacious film.

HERESITE & CHEMICAL COMPANY—Manitowoc, Wisconsin

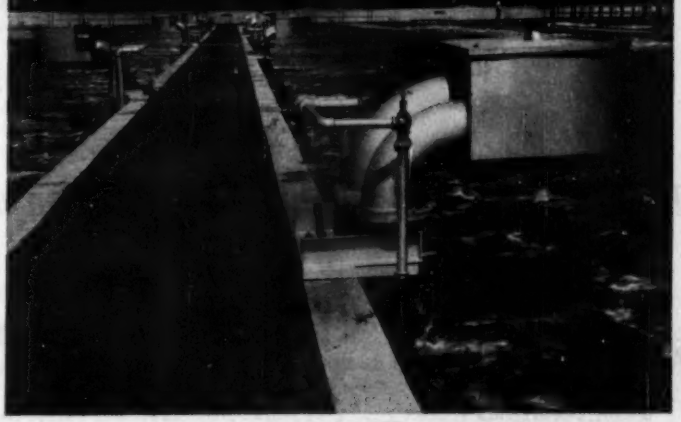
Branch Office: 327 South LaSalle Street, Chicago, Ill.



MORE EFFECTIVE... MORE ECONOMICAL WASTE TREATMENT



impingement aerator **DIFFUSAIR**



Stream Pollution Problem Solved at Kirkwood, Mo.

By providing effective aeration and tank liquor agitation, this installation has completely solved Kirkwood's problem of stream pollution.

Empty tank shows headers carrying impingement aeration equipment. Highly effective mixing and oxygenation of tank liquor is evident in photo of full tank.

Not even one case of air orifice clogging or blow-back pressuring has ever been encountered!

DIFFUSAIR is Effective, Economical and Trouble-Free

An Impingement Aerator efficiently diffuses air as very small bubbles to agitate and oxygenate aeration tank liquors. By use of a highly developed Diffusion Nozzle, a turbulent region is created around this nozzle so that the large air bubbles being discharged through the four high velocity non-clogging orifices immediately enter this turbulent region. Resultant cavitation effect divides the air into smaller bubbles than those diffused from a No. 30 permeability porous tube.

Since the air is released along headers through high velocity orifices no air clogging is possible. No filtering of the compressed air supply is required because there are no small orifices to be clogged by dust.

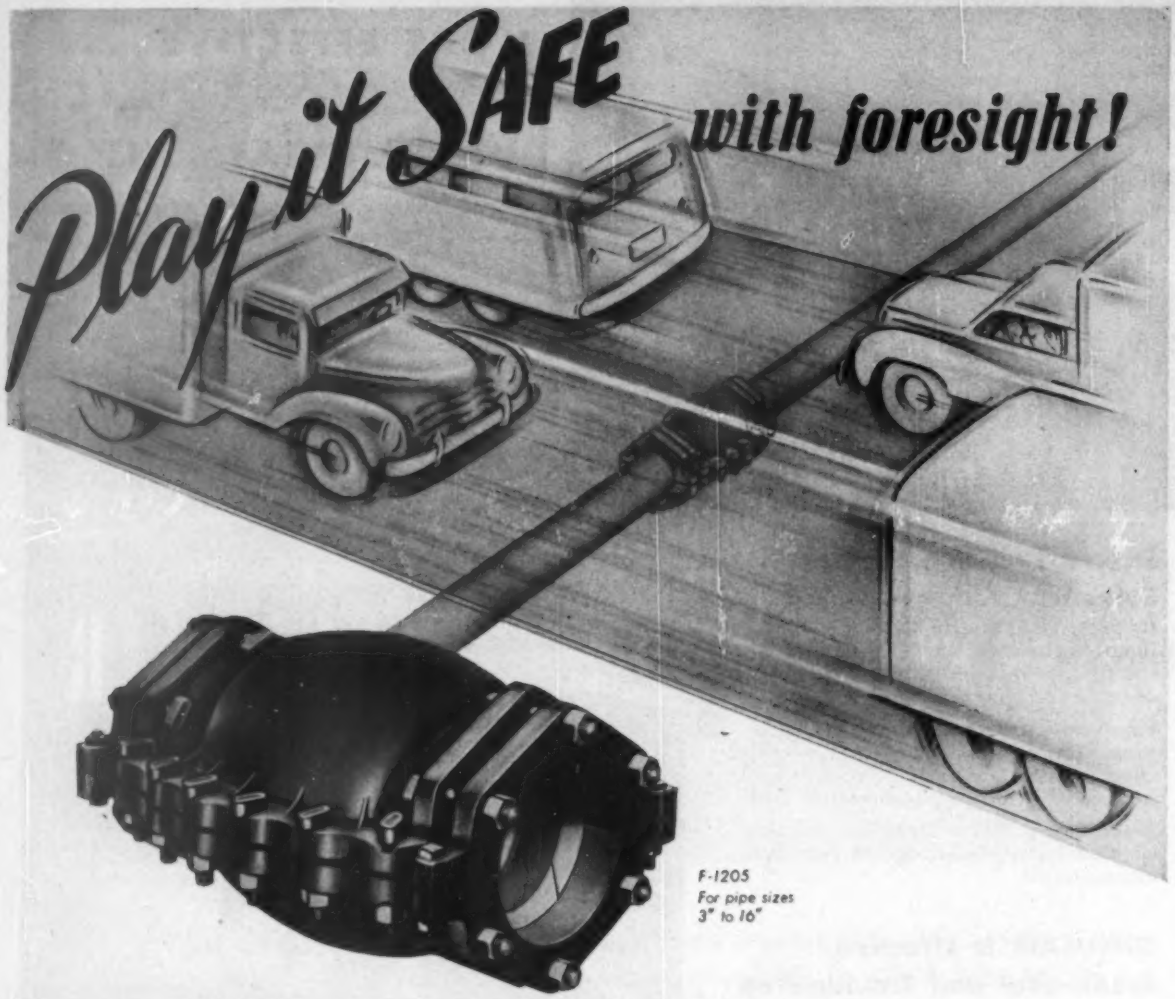
Los Angeles Protects its Bathing Beaches

The many beautiful bathing beaches of Los Angeles would be impossible were it not for the purity of the streams entering the Pacific along its waterfront. To assist such purity, engineers specified this DIFFUSAIR installation at Los Angeles Hyperion activated sludge plant. Photo above shows effective aeration, tank liquor agitation and surface velocity.

WE MANUFACTURE A COMPLETE LINE OF EQUIPMENT FOR THE TREATMENT OF SEWAGE AND INDUSTRIAL WASTES

WRITE FOR BULLETIN 22552

WALKER PROCESS WALKER PROCESS EQUIPMENT INC.
FACTORY • ENGINEERING OFFICES • LABORATORIES
AURORA • ILLINOIS



F-1205
For pipe sizes
3" to 16"

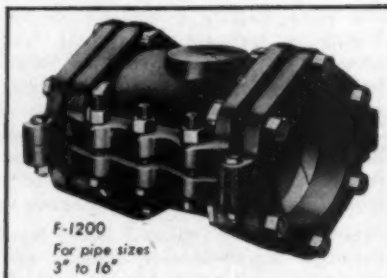
Reinforce all joints subject to vibration with

CLOW

Mechanical Joint BELL SPLIT SLEEVES

When ponderous trucks roar and rumble by, even our finest highways tremble with vibration . . . and so does the water pipe buried below! That's why it's best to play it safe: don't wait for a break; have the foresight to install Clow Mechanical Joint Bell Split Sleeves as *original equipment* wherever the pipe must pass under highway truck routes or under railroad tracks. Specify them for marshland or under water, too—in fact, everywhere that pipe is not readily accessible in case of emergency. They're easy to install . . . no lead, no jute, no caulking!

Write for circular with helpful information and illustrations



F-1200
For pipe sizes
3" to 16"

Use these F-1200 Clow Mechanical Joint Straight Split Sleeves for permanent repairs to pipe barrels. 12" and smaller sizes will repair lengthwise breaks up to 8 inches; 14" and 16" sizes, up to 17 inches.

JAMES B. CLOW & SONS

201-299 North Talman Avenue • Chicago 80, Illinois

and their National Cast Iron Pipe Division, Birmingham, Alabama; subsidiaries Eddy Valve Company, Waterford, N.Y.; Iowa Valve Company, Oskaloosa, Iowa

Packaged

1. SMALL MUNICIPALITY SEWAGE TREATMENT
2. INDUSTRIAL WASTE TREATMENT

HIGH EFFICIENCIES • LOW SPACE REQUIREMENTS • PROVEN PERFORMANCE

→ PRIMARY FLOTATION CLARIFIERS

Prefabricated flotation cells utilizing the dissolved gas method for high efficiency on a wide variety of suspended solids, oils, and greases. Available in sizes from 25 G.P.M. to 2000 G.P.M. in steel, and to 6000 G.P.M. in tile or concrete.

→ PACKAGED TRICKLING FILTERS

The Colloidair Trickling Filter is of package design for economical installation where smaller sizes are indicated. Standard and high rate models.

→ ROTARY VACUUM and PLATE and FRAME FILTERS

Complete line of rotary vacuum filters utilizing precoat sweetener or flocculents. Complete line of plate and frame or tubular element filters, manual or automatic backwash.

Bulkley-Dunton engineered sewage and waste water treatment equipment meets city and state disposal requirements. Write for details!

BULKLEY-DUNTON PROCESSES, INC.

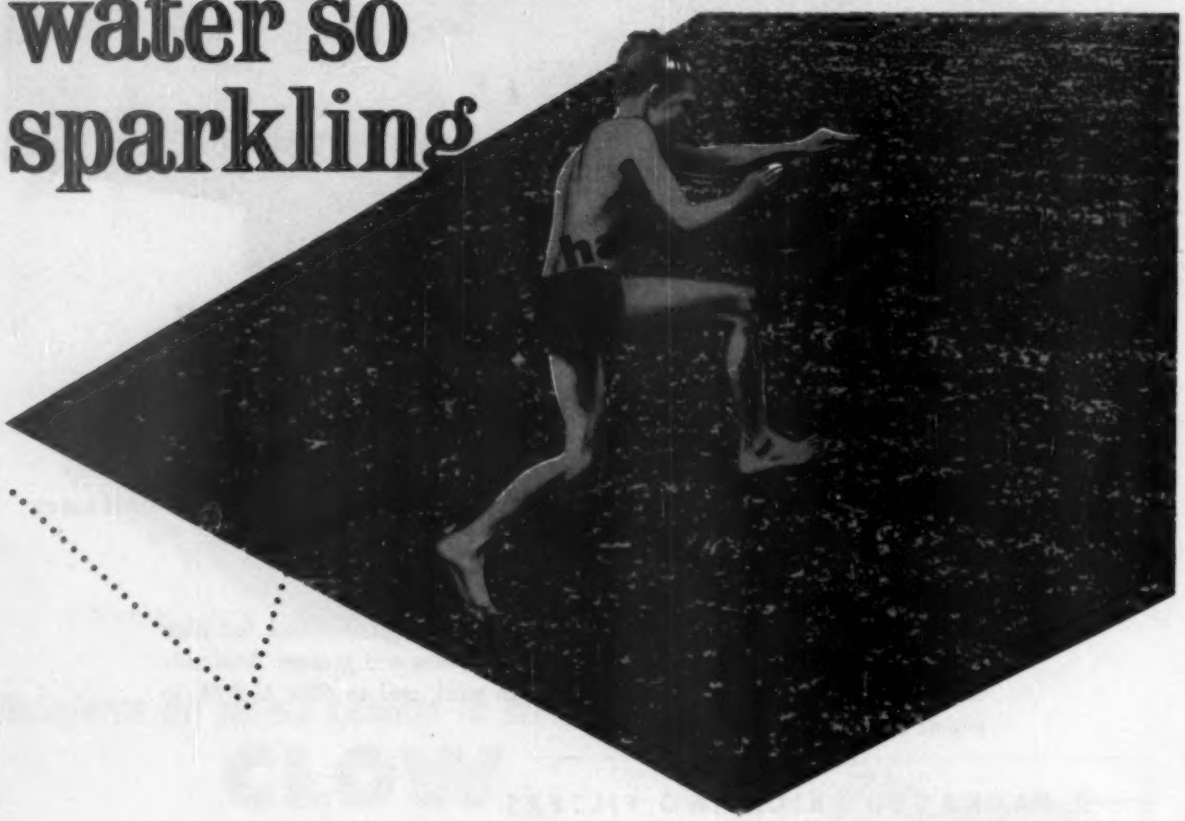
Dept. N-1, 295 Madison Avenue, New York 17, N. Y.

Pacific Coast: Dept. N-1, Security Building, Pasadena, Calif.

Aqua Nuchar....

the activated carbon to give your water a refreshing glisten. Not only does Aqua Nuchar economically remove unwelcome odors and tastes, but it as well imparts to ordinary clear water a cool, glimmering, inviting effect whose brilliant qualities reflect like a perfect crystal.

water so sparkling



As a preliminary measure in obtaining these results from your water treatment processes why not have our Threshold Odor Experts come and give you our introductory survey. They will recommend how to use Aqua Nuchar to the best advantage with the other chemicals employed in your procedures. Contact Industrial's Technical Service Department today for complete particulars.

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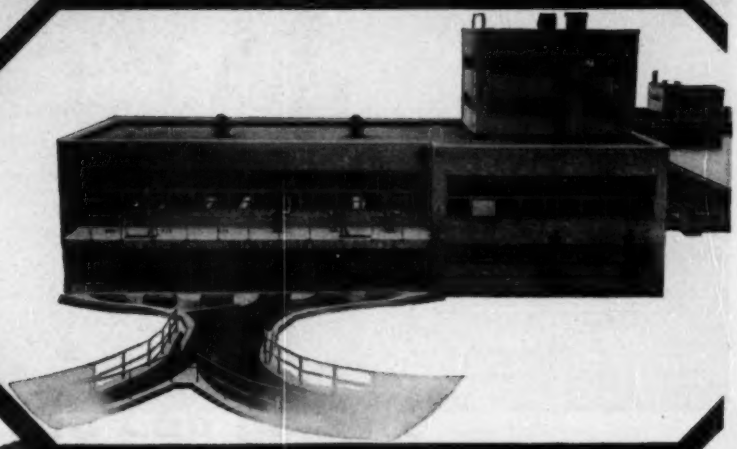
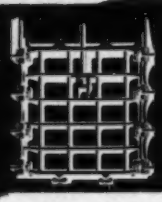
FOR SLUICE GATES
large or small

SPECIFY
RODNEY HUNT





Rodney Hunt cast iron bronze-mounted sluice gates are used throughout this modern sewage treatment plant at Bucklin Point, East Providence, R. I. Here, there are Rodney Hunt gates 96 x 96, 84 x 96, 60 x 72, 48 x 72, 36 x 24, 24 x 36, and 24 x 18; wall thimbles are in place for 19 more gates in sizes up to 96 x 120 to be installed as need arises.

There are 2000 combinations of types and sizes of Rodney Hunt standard cast iron bronze-mounted sluice gates, giving engineers a very wide selection of rectangular clear openings up to 120" x 120" or diameters up to 108". Experienced engineering and traditionally good New England skill in our foundry and machine shop assure trouble-free low-cost operation of Rodney Hunt Sluice Gates. We bid competitively and make firm deliveries to meet construction schedules.

FREE
232 page Catalog

Our elaborate catalog contains photographs, drawings, specifications and descriptions of Rodney Hunt cast iron bronze-mounted sluice gates, timber gates, hoists, valves, racks and rakes.

A 28-page section gives valuable engineering data on hydraulic problems.

This catalog was prepared for consulting engineers, contractors and others *actively* engaged in water control. Write on your letterhead for Catalog WCA-952.

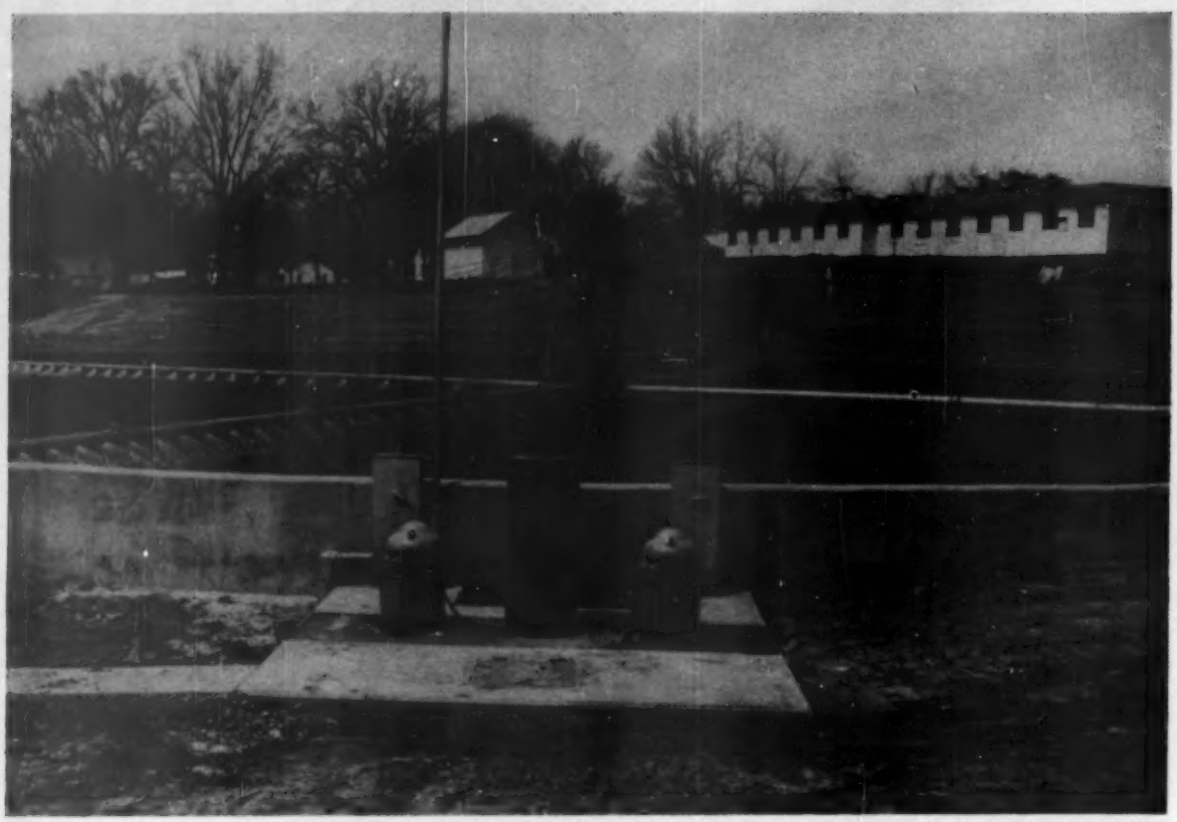
RODNEY HUNT®

Manufacturing Engineers Since 1840

RODNEY HUNT MACHINE CO.

84 Lake Street, Orange, Mass., U.S.A.

Critical Jobs Are Routine for Johnston Pumps!



TAKE BIOFILTRATION, FOR EXAMPLE...

Here are two Johnston Propeller Pumps recirculating effluent to the trickling filter and dosing tank at the rate of 2300 gallons per minute in a new sewage treatment plant in Jacksonville, Illinois. Normally these units operate individually but, when needed, both will run at the same time to take care of overloads or other emergencies.

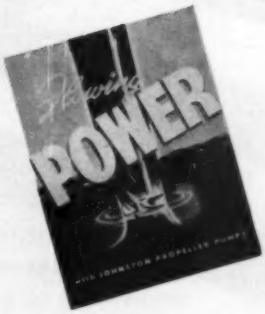
There are many reasons why Johnston Pumps were selected for this job. Here are just three:

1. Equipped with stainless steel bowl shafting.

2. Removable aluminum-bronze bowl liner is not an extra-cost item—it's standard on a Johnston Propeller Pump.

3. Discharge elbow holds hydraulic losses to a minimum, while giving the user the advantages of economical construction.

This is another example of the ability of Johnston equipment to handle all kinds of pumping jobs. For the kind of pump "know-how" that puts money in the bank, see your Johnston Dealer, or ask a factory representative to call. They're always glad to help.

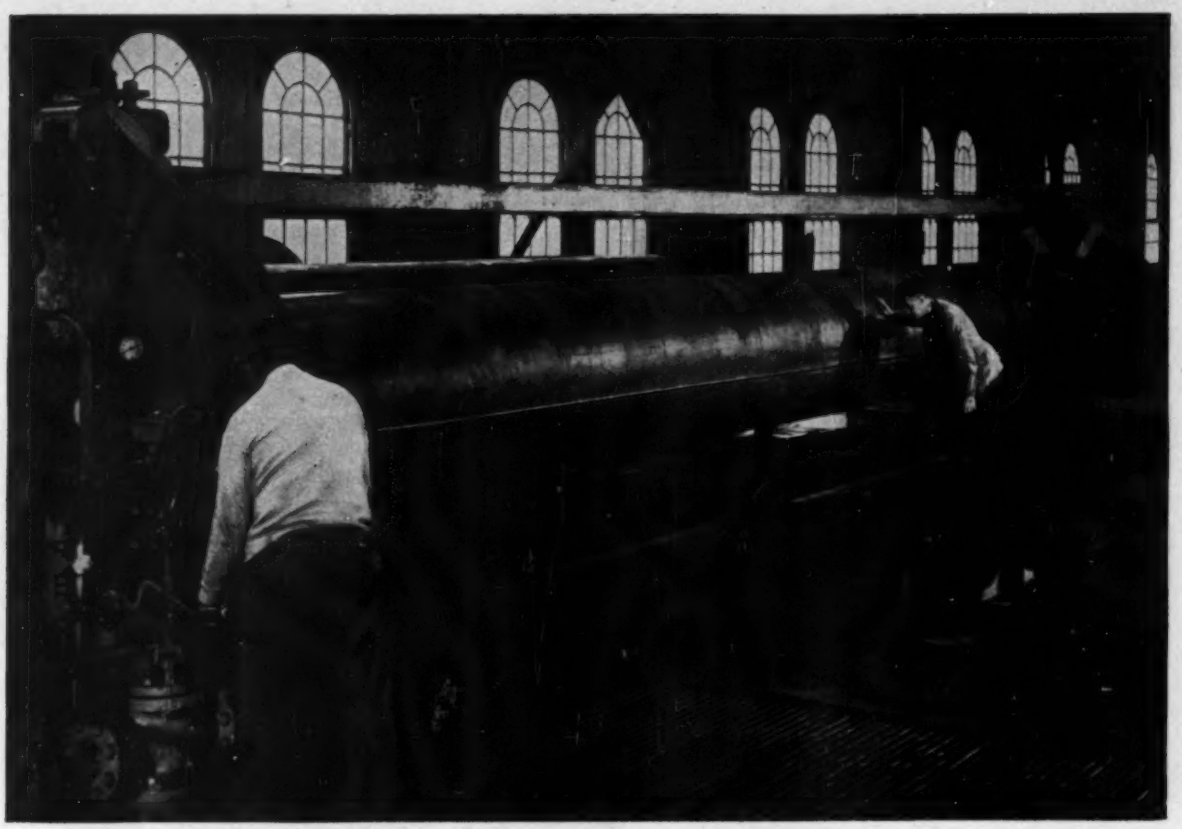


Send today for your free copy of "Flowing Power". Ask for Bulletin K-14

JOHNSTON VERTICAL PUMPS

JOHNSTON PUMP COMPANY

3272 EAST FOOTHILL BLVD., PASADENA 19, CALIFORNIA



Why You Can Be Sure about The Strength of Steel Pipe

The photograph shows a 40-ft length of Bethlehem Steel Pipe undergoing a hydrostatic test at our Steelton, Pa., plant. This test is carried out in accordance with AWWA requirements, the pipe being subjected to a test equivalent to 200 pct of the working pressure.

Each length of Bethlehem Pipe, whether for water- or sewage-line service, is tested in this way to prove its strength and water-tightness. The test also shows conclusively why Bethlehem Tar-Enameled Steel Pipe is a reliable pipe for any type of sewage line.

In addition to its strength and water-tightness, Bethlehem Tar-Enameled Pipe has these other worthwhile advantages:

It resists corrosion, because the pipe is lined and coated with a smooth, uniform layer of coal-tar enamel. The lining, being impervious to corrosion and incrustation, ensures high flow-coefficients for the life of the installation.

It is also resistant to water-hammer. It can carry a load of nearly four times the working pressure. In addition, it has the resilience to "give" with soil movement, making it immune to the effects of surface vibrations.

Bethlehem Tar-Enameled Pipe can be joined into a tight, sound line by mechanical couplings, or by welding or riveting. The pipe is generally furnished in 40-ft lengths. It comes in diameters from 22 in. i.d. through 150 in. i.d., and in thicknesses to accommodate any working pressure.

Perhaps you would like to have complete information about Bethlehem Tar-Enameled Pipe. If so, all you need do is drop a line to the nearest Bethlehem office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

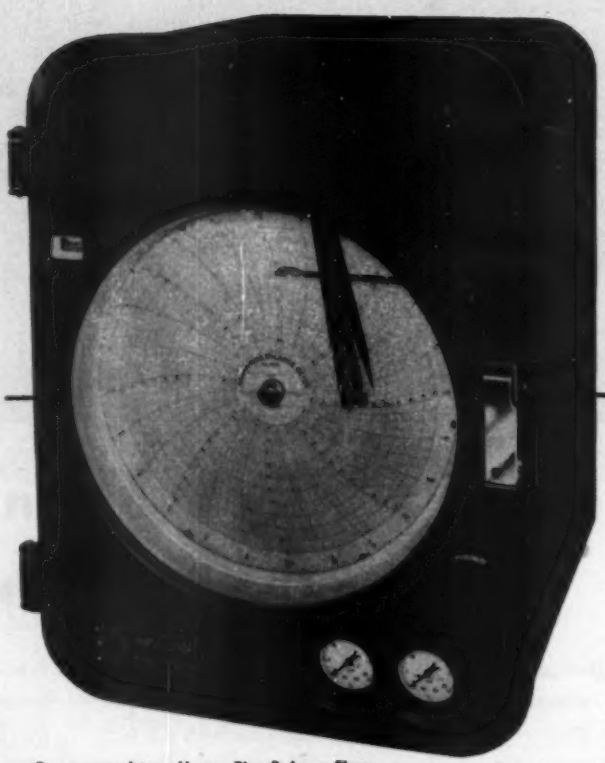
BETHLEHEM STEEL

BETHLEHEM *Tar-Enameled* STEEL PIPE

accurate measurement of low differentials is NOT a problem for **HAGAN RING BALANCE METERS**

The highest differential available is most desirable for every meter application. In many liquid flow systems, however, the differential must be kept just as low as possible.

Consider these advantages of the Hagan Ring Balance Meter, particularly when the full scale differential must be low:



Compensated type Hagan Ring Balance Flow Meter, recording corrected and uncorrected flows, and indicating the correction factor. This model is also equipped with Hagan Pneumatic Signal Transmitter.

A complete series of interchangeable sensing elements is available for measuring full scale differentials from 1" to 420" WC, at static pressures up to 3000 psig.

For each installation, the ring assembly is selected to have ample power for accurate operation of the meter at all flows.

The differential measuring range of any ring is adjustable over a 7 to 1 ratio. Calibration can be checked with dead weights in a few minutes, without removing the meter from the line.

Automatic compensation, for such factors as fluid density, temperature or pressure, is a standard attachment.

Pneumatic or electric transmission is available for remote recording or for automatic control purposes.

The Hagan Ring Balance Meter is the most versatile unit available for flow measurements with any source of differential—orifice plate, venturi tube, pitot tube, weir or flume.

We will be glad to suggest the metering equipment best suited for improving an existing installation, or for extensions and new construction.

HAGAN CORPORATION

HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA

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BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND
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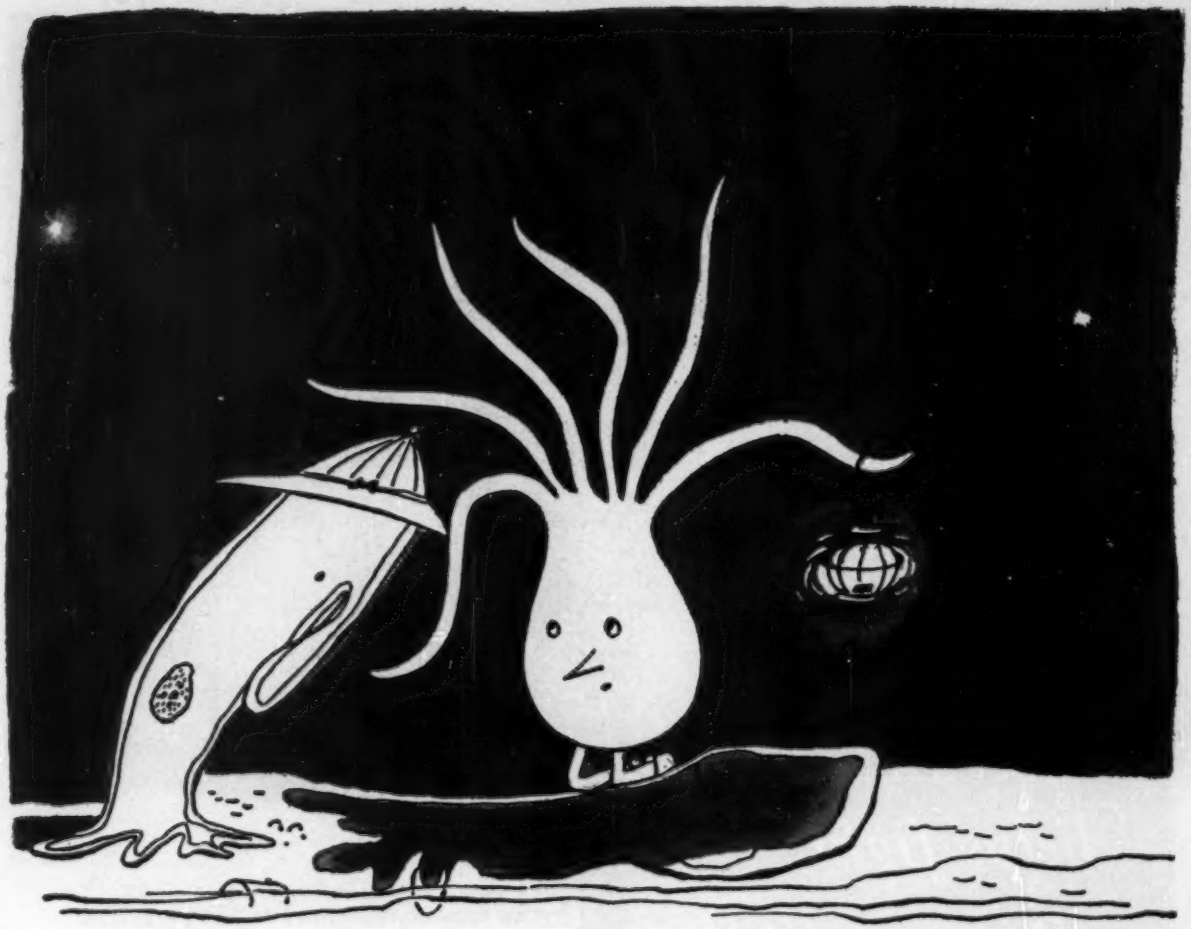
METALLURGICAL FURNACE CONTROL SYSTEMS
CONTROL SYSTEMS FOR AUTOMOTIVE AND
AERONAUTICAL TESTING FACILITIES



"Just plain suicide, Orgie—he touched PITTCHLOR®"

That's right, Orgie, Pittchlor is sure death every-time.

Pittchlor—a high-test calcium hypochlorite containing a minimum of 70% available chlorine—kills chlorine-susceptible bacteria and algae on contact. Pittchlor works fast and effectively in chlorinating water supplies, treating sewage, and wherever the germicidal and deodorizing action of chlorine is needed.

Pittchlor is dry, white and free-flowing. Its granular form permits ease of application either manually or by mechanical feeders. Write for free folder on the use in which you are interested.

FOR
WATER PURIFICATION
SEWAGE TREATMENT
SWIMMING POOL
SANITATION.

Stocked by leading jobbers in 5 lb. resealable cans (9 per case), 3¼ lb. cans (12 per case) and 100 lb. and 130 lb. drums.

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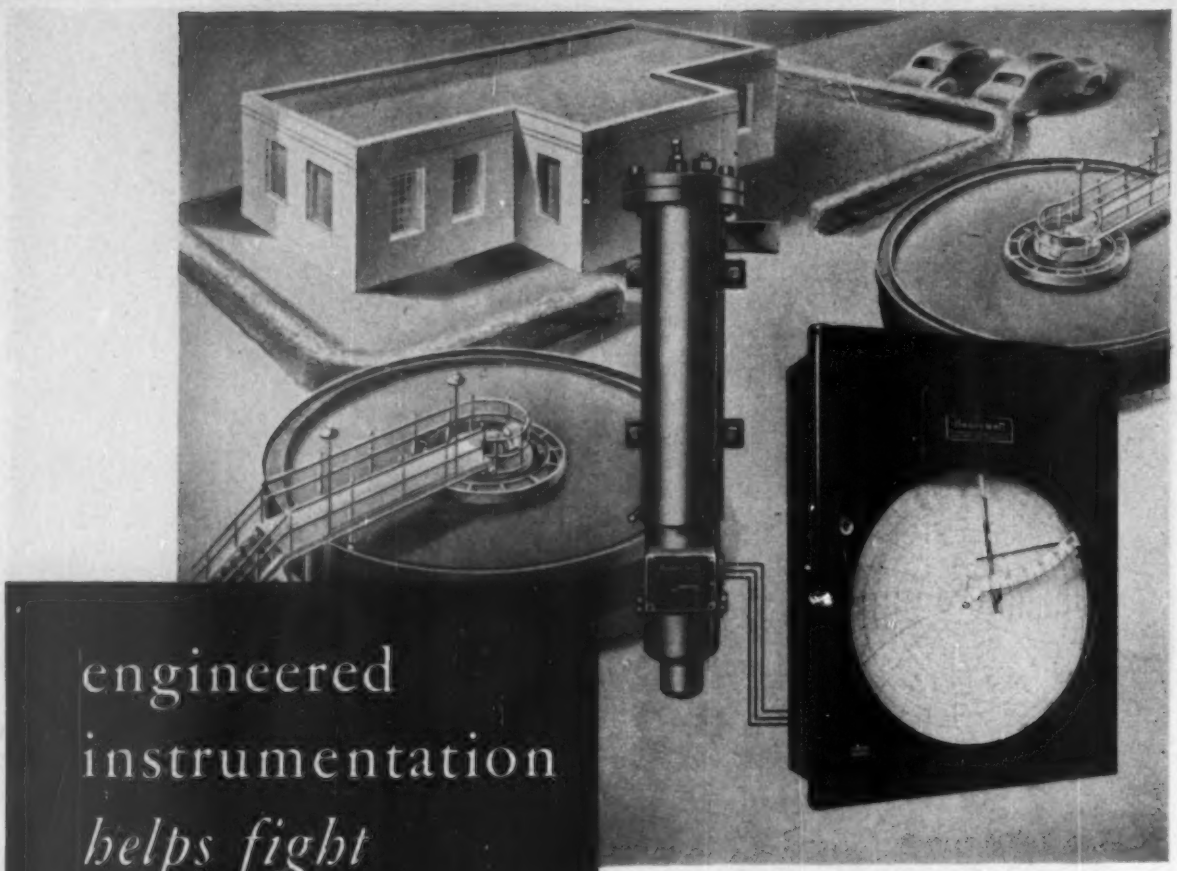


engineered instrumentation *helps fight stream pollution*

PLAN FLOW INSTRUMENTATION FOR THE FUTURE *—by selecting the Brown Evenly Graduated Flow Meter. This instrument provides accurate measurement at fractional-scale readings—gives full precision when your plant is running at part load, and after it has grown to final capacity.*

WHEREVER your waste treatment plant needs to measure and totalize flow—of plant influents, effluents, filter backwash water, gas, carbon dioxide, and numerous other fluids—you'll find the Brown Evenly Graduated Flow Meter the ideal solution to your problems.

Its linear scale and chart are uniformly accurate and readable across the entire range . . . are free from the difficulties of reading compressed markings near the zero point. Built-in electronic integration adds up total flow accurately for convenience in flow cost accounting and process analysis. The instrument is supplied as an electric type for remote recording, or as a mechanical meter with direct-coupled meter body.

The Brown Flow Meter embodies simple, rugged construction in every detail. The meter body is corrosion resistant, light-weight and sturdy. And to assure you of continuous performance, Honeywell's widespread organization offers prompt, experienced service.

Your local Honeywell engineering representative will be glad to discuss your plant's instrumentation requirements with you and your consulting engineer . . . to apply the experience which Honeywell has gained through years of work in this field. Call him today . . . he is as near as your phone.

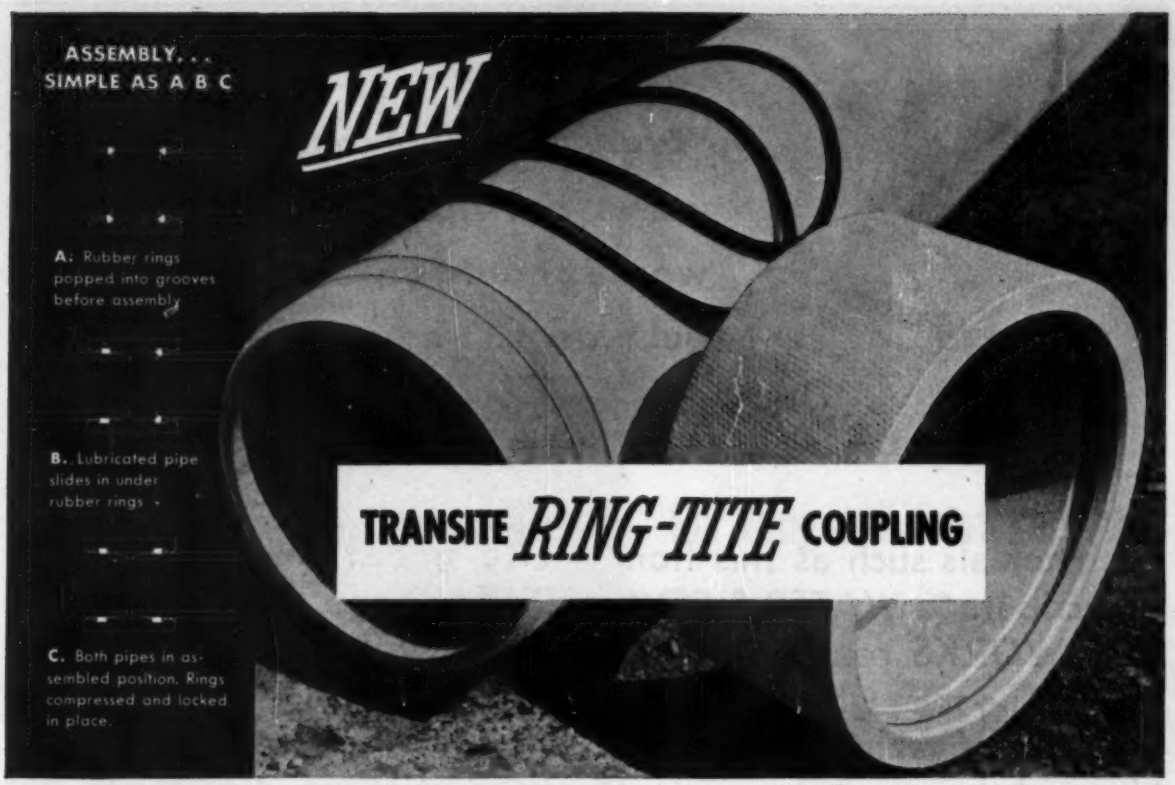
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4575 Wayne Ave., Philadelphia 44, Pa.

● REFERENCE DATA: Write for Catalog 2300, "Evenly Graduated Flow Meters"

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls


ASSEMBLY...
SIMPLE AS A B C
NEW
A. Rubber rings popped into grooves before assembly
B. Lubricated pipe slides in under rubber rings
C. Both pipes in assembled position. Rings compressed and locked in place.
TRANSITE RING-TITE COUPLING

Coupling and Pipe made of strong, corrosion-resistant asbestos-cement Transite

Cuts installation costs through fast assembly—insures locked-in tightness

Pipeline assembly can be made easy, fast and practically foolproof with the Johns-Manville Transite® Ring-Tite® Coupling. This is the new asbestos-cement coupling for Transite Pressure Pipe that gives every joint locked-in tightness.

Record savings achieved

The Ring-Tite Coupling is effecting installation savings every place it is used. Every step of the way, its special advantages and automatic features pay off.

To begin with, pipes need only rough alignment. The design of the coupling does the rest with automatic centering, automatic aligning and automatic adjusting for expansion. Rings are simply popped into grooves and pipes pulled together.

Pipe ends are automatically separated within the coupling. This provides for expansion and flexibility . . . permits line to conform to curves . . . to withstand shock and vibration . . . to relieve line stresses.

With the Transite Ring-Tite Coupling, no complicated equipment is required. Installations can be successfully completed under adverse weather, temperature or terrain conditions. And the Ring-Tite Coupling is listed by Underwriters' Laboratories, Inc.

Savings at fittings, valves and hydrants, too

The Ring-Tite Coupling saves money and time by joining pipe directly to fittings, valves and hydrants embodying the Ring-Tite design.

A TYPICAL PERFORMANCE REPORT— On the Florida installation illustrated in the photograph, a rate of progress as high as 640 feet an hour was achieved—exceeding by far the speed anticipated considering the job conditions.

For further information write to Johns-Manville, Box 60, New York 16, N. Y.

Johns-Manville TRANSITE PRESSURE PIPE

"Every individual connected with water purification or sewage works should subscribe to this publication. I have introduced it to a host of friends in this field"

Testimonials such as this from subscribers to WATER & SEWAGE WORKS really tell the story. The man who reads and uses the magazine as an aid in his work knows how much it will benefit other workers in the field.

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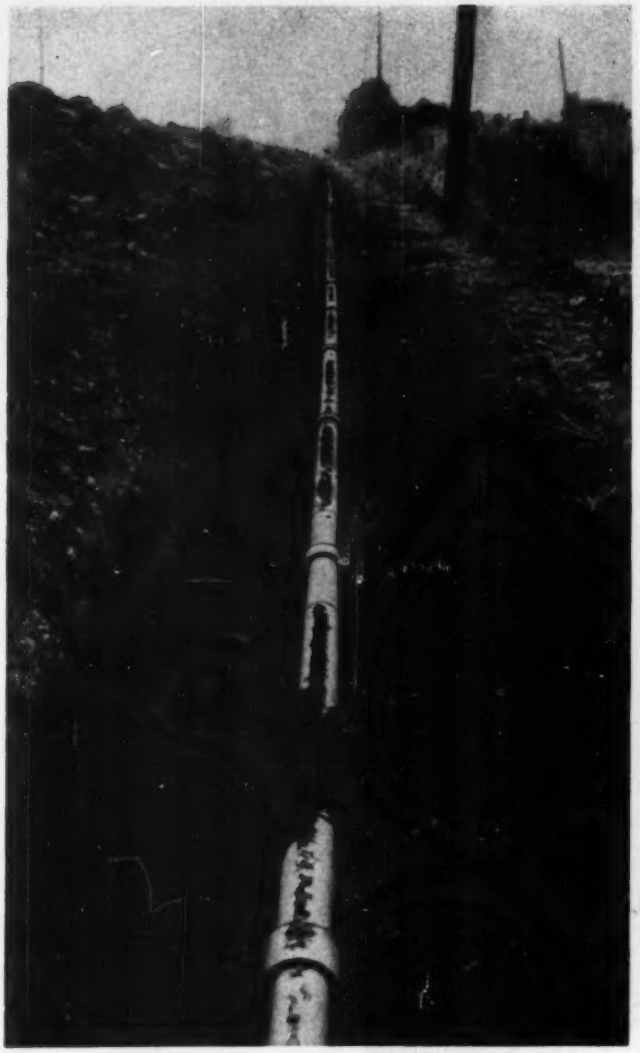
(Add $1.00 per year for foreign postage)

- *If you are interested in the water field only you get all the authoritative data on this subject.*
- *If you are interested in sewage problems only you are kept fully informed and given much help in this field.*
- *If you are interested in both subjects you get all the information in this one monthly magazine.*



For long efficient service specify "Century"® ASBESTOS-CEMENT PIPE

The importance in an industrial installation of a water supply line for fire protection cannot be minimized. And "Century" pipe offers a distinct advantage.

No need for concern that one day as a result of tuberculation, the line will carry less water and be inadequate to meet an emergency. That cannot happen with "Century" pipe. The bore retains its original diameter and smoothness—a very real advantage for any pipe intended for water supply.

"Mains Without Maintenance" is an informative booklet of real value to anyone concerned with water mains. Write for it.

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

Nature made asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

The difference between Life... and Death...

"Why should you give blood? Ask me—I ought to know. I fought in Korea. But since then I've been through the biggest battle of all—the battle for life itself. And it was blood—and blood alone—that saved me. Don't know when I'll be in a position to start repaying my debt by giving some blood of my own. But I will—some day. You can count on it!"

All kinds of people give blood—for all kinds of reasons. But every reason for giving blood is a *special* reason . . . just as every American life that can be saved at any time and at any place . . . is special. So whatever *your* reason for giving blood, this you can be sure of: Whether it goes to a combat area, a local hospital, or for Civil Defense needs—this priceless, painless gift will some day save an American life!

Business Executives!

✓Check These Questions!

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ☐ Have you given your employees time off to make blood donations?
- ☐ Has your company given any recognition to donors?
- ☐ Do you have a Blood Donor Honor Roll in your company?
- ☐ Have you arranged to have a Bloodmobile make regular visits?
- ☐ Has your management endorsed the local Blood Donor Program?
- ☐ Have you informed employees of your company's plan of co-operation?
- ☐ Was this information given through Plant Bulletin or House Magazine?
- ☐ Have you conducted a Donor Pledge Campaign in your company?
- ☐ Have you set up a list of volunteers so that efficient plans can be made for scheduling donors?

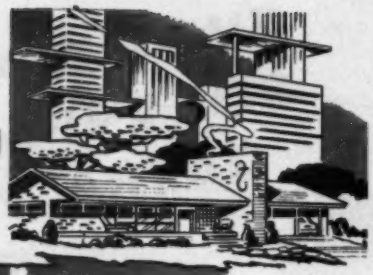
Remember, as long as a *single* pint of blood may mean the difference between life and death for *any* American . . . the need for blood is *urgent!*

Give Blood Now

CALL YOUR RED CROSS TODAY!

NATIONAL BLOOD PROGRAM

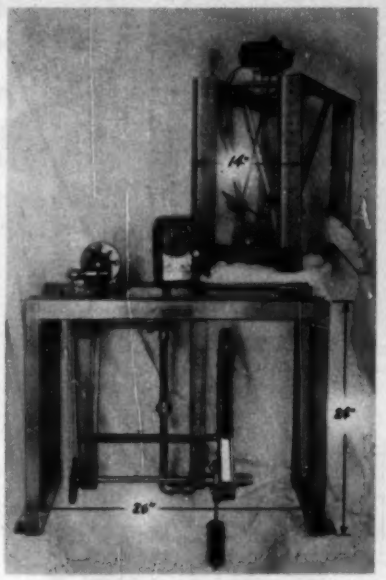
the **MODERN** approach



Cast iron pipe centrifugally cast and with mechanical joints is the most efficient and economical means of modern day distribution. Serving the industry with Super de Lavaud cast iron pipe centrifugally cast in modern long lengths with standardized Mechanical Joints, Bell and Spigot or Flanged, with or without centrifugally applied cement lining. Rugged, dependable and economical.

General Sales Offices
ANNISTON, ALABAMA
We invite inquiries to our nearest sales office
122 So. Michigan Avenue, Chicago 3, Ill. — 350 Fifth Avenue, New York 1, New York

ALABAMA PIPE COMPANY
ANNISTON ALABAMA

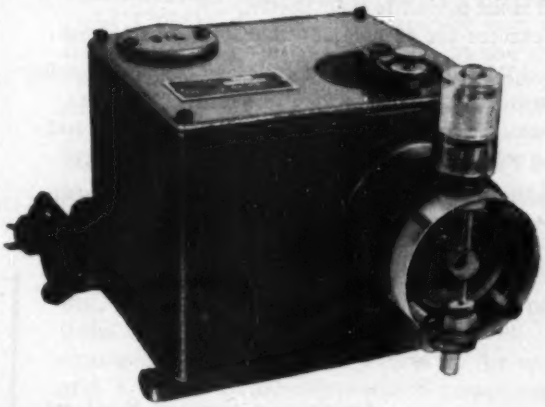


The Trebler Sampler will provide you with a low cost and efficient sampling unit.

Write for bulletin 131

Lakeside Engineering Corporation
222 West Adams St. Chicago 6, Ill.

PRECISION Chemical Pumps



for

Chlorinating swimming pools, drinking water, waste
Fluoridation of municipal water supplies
Corrosion and scale control, phosphate injection
Chemical waste treatment
Automatic sampling

Accurate, dependable, positive displacement, diaphragm type pumps. Constant rate or meter paced for automatically variable output.

PRECISION MACHINE COMPANY
8 Walnut Street Somerville, Mass.

NO "CRYSTAL BALL" NEEDED

Detectron "505"
PIPE DETECTOR
takes all guesswork out of Pipe Detection

◀ DETECTS, TRACES and CENTERS PIPE, CABLE, ETC.
◀ ESTIMATES EXACT DEPTH
◀ SEPARATES PARALLEL PIPE, CABLE and CONDUIT

A crystal ball might be one way to locate buried pipe or cable at an excavation site. But . . . a *better, safer* and *more efficient* way is to use the new, improved Detectron "505" that accurately pinpoints the exact length, depth and location. *Stop guessing —and be sure!*

Send today for FREE Catalog No. 57

THE *Detectron* CORPORATION
5420 VINELAND AVE., NO. HOLLYWOOD, CALIF.

At your age!

If you are over 21 (or under 101) it's none too soon for you to follow the example of our hero, Ed Parmalee, and face the life-saving facts about cancer as presented in our new film "Man Alive!". You'll learn, too, that cancer is not unlike serious engine trouble—it usually gives you a warning:

(1) any sore that does not heal (2) a lump or thickening, in the breast or elsewhere (3) unusual bleeding or discharge (4) any change in a wart or mole (5) persistent indigestion or difficulty in swallowing (6) persistent hoarseness or cough (7) any change in normal bowel habits.
While these may not *always* mean cancer, any one of them should mean a visit to your doctor.
Most cancers are curable but *only* if treated in time!

You and Ed will also learn that until science finds a cure for *all* cancers your best "insurance" is a thorough health examination every year, no matter how well you may feel—twice a year if you are a man over 45 or a woman over 35.

For information on where you can see this film, call us or write to "Cancer" in care of your local Post Office.

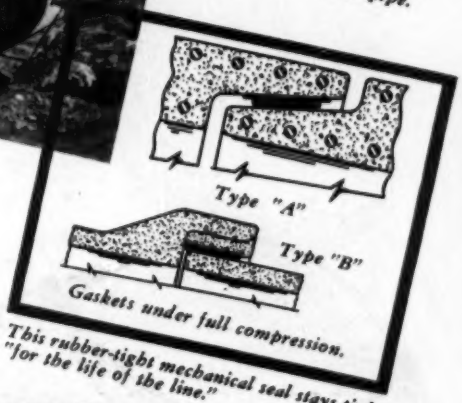
American Cancer Society

MAN ALIVE! is the story of Ed Parmalee, whose fear weakens his judgment. He uses denial, sarcasm and anger in a delightful fashion to avoid having his car properly serviced and to avoid going to a doctor to have a symptom checked that may mean cancer. He finally learns what a difference it makes (in his peace of mind and in his disposition) to know how he can best guard himself and his family against death from cancer.

PUT YOUR PIPE JOB AHEAD 3 Ways...

The only preparation required for TYLOX Joints is to snap on Gaskets and paint sliding surfaces with Tylox Cement.

After preparation, merely shoving the pipe home makes a permanently tight joint . . . even in hard-to-handle, large diameter pipe.



This rubber-tight mechanical seal stays tight "for the life of the line."

Specify

TYLOX

Flexible Rubber PIPE JOINTS

Fast-working, long-lasting and *compression*-tight TYLOX Pipe Gaskets are the sure way to put your pipe projects *ahead*, in the three most important aspects of sewerage and drainage work. Write "TYLOX RUBBER JOINTS" into your specifications and count on: MORE PIPE DOWN PER DAY—TYLOX specifications encourage economical sewer bidding because contractors can lay pipe faster, and your job stays on or ahead of schedule . . . TYLOX not only eliminates all costly mortaring, calking, collaring or "pouring" operations but other expensive delays as well. For example, wet trenches can't slow up the work, and TYLOX *flexibility*—which compensates for angularities in the line—permits immediate backfilling . . . even use of straight pipe "on radius."

TROUBLE-FREE OPERATION—Low maintenance is inherent in TYLOX-jointed pipe lines . . . Made of specially compounded rubber which acids, alkalies or abrasives cannot affect, TYLOX won't corrode or deteriorate . . . it doesn't have to be "dug up" for repairs . . . it keeps damaging roots and sediment *out* of the pipe, reducing *future* maintenance requirements of the line.

NO INFILTRATION PROBLEMS—You can cut your design permissibles for infiltration *way down* with TYLOX Joints . . . TYLOX Rubber Gaskets seal by compression, not—as in the case of bituminous or mortar joints—by adhesion. When the pipe is shoved home, TYLOX "packs" the joint's annular space tight by mechanical action, and the natural resilience of the rubber *keeps* it tight. Vibration, shock loads and soil stresses cannot affect this seal, and the joint is infiltration-proof for the life of the pipe itself.

Take advantage of these TYLOX features to put *your* pipe projects ahead 3 ways . . . Make it a point to specify TYLOX RUBBER JOINTS on *every* sewerage and drainage installation you plan.

Write for specification data and illustrated case histories on Tylox Rubber Joints.

1860

HAMILTON KENT MANUFACTURING COMPANY
427 W. Grant St. • Kent, Ohio

how much does it cost to stand pat?

It isn't often that a new development comes along that affects chlorine handling—in fact, not in the past 35 years has there been news as important as this to you and your community.

You may feel it costs you nothing to let new developments in chlorine handling go by the board. *But it costs your community plenty*—in money, in better chlorination and in better, *safer* handling methods.

Ratochlor units in F & P Hatboro plant awaiting inspection and test with chlorine under actual operating conditions.

AN ENTIRELY NEW WAY TO CHLORINATE

Not in 35 years has such a completely new, easy operating, dependable and economical chlorinator been made. There are many reasons why this has been so. One of the most important reasons is that suitable materials that could remain inert to corrosion *were not yet invented.* As a result of wartime needs, many new materials are available now that were not in the laboratory stages even ten years ago.

The most positive way to regulate and control chlorine is the diaphragm regulator principle. But until these corrosion resistant materials were invented, a regulator could not be made that lasted against corrosion. The regulator principle is successfully used in the new Fischer & Porter Ratochlor unit, along with such new products as Uscolite, manufactured by U.S. Rubber Co., Kel-F, Hastelloy, Teflon, and such timeless materials as silver and tantalum.

Old fashioned, out-of-date chlorine dispensing equipment uses vulnerable water seals, whereas in the Ratochlor unit, chlorine is always handled in fully enclosed, tightly sealed, corrosion resistant pipes and components. Chlorine losses from old fashioned design lead to increased corrosion, thus to excessive operating costs. Constant service calls add to costs, repeated maintenance charges mean that you still have an old fashioned unit with most original parts replaced. Such costs are cut to the bone with the new Ratochlor chlorinator.

The Fischer & Porter chlorinator was completely engineered to take advantage of all new developments, was then exhaustively tested in the field for five years. Now you can be sure of the finest in chlorination equipment. Even the outside cabinet is so new, of corrosion resistant *fibre-glass,* that it never needs painting, is resilient to withstand blows and vibrations. The Ratochlor unit is superior in every way. It is low in first cost, costs little to maintain.

You owe it to yourself and your community to *know* about this dependable, safe, less costly way of handling chlorine. Complete facts, fully illustrated, will be sent to you if you will request them right now.

EVERY RATOCHLOR IS BACKED WITH AN IRON-CLAD GUARANTEE

You can't go wrong in replacing old fashioned equipment NOW with the F&P Ratochlor chlorinator. Here's why. Fischer & Porter is a major company, leaders in flow control instrumentation. Hundreds of tons of live chlorine are handled daily by F&P Flowrator* meters in the chemical industry. The Ratochlor unit is so superior to any ever offered, so simple in design and control that it is almost entirely free of costly, repeat service calls. Equipment now in daily use in many communities shows that yearly maintenance costs are a fraction of older units.

Fischer & Porter stands four-square back of *every* Ratochlor unit. Before you agree to buy, F & P will install a Ratochlor chlorinator for a thirty day test period. During this time, you can subject this new unit to any kind of test you can make. *You must be fully satisfied.*

And the day you install your first Ratochlor unit, is the first day of a full year during which you must continue to be fully satisfied with it. Even at the end of one year, if you're not fully satisfied, the Ratochlor unit will be taken out and the full cost—every cent of it—will be refunded. You can't lose with the Ratochlor chlorinator.

complete process instrumentation

FISCHER & PORTER CO.

*T.M., F&P CO.

3910 Fischer Road, Hatboro, Penn.

Company owned sales and service branches strategically located throughout the world.

8381

No words needed...

Before ever he speaks a word, he asks your love.
In it begins the security he will need forever.

The whimper when he's hungry, the sigh of peace when he's fed and warm, the cuddle of his sleepy body—all these tell a need that never ends.
The need that none of us outgrows: to be safe and secure in body and heart as long as we live.

The security of our homes is a universal dream. That each of us is free to make secure the lives of those we love, is our peculiar privilege.

As we take care of our own, we also take care of America. Out of the security of each home rises the security of our country.

Your security and your country's begin in *your* home.

Saving for security is easy! Read every word—now! If you've tried to save and failed, chances are it was because you didn't have a *plan*. Well, here's a savings system that really works—the Payroll Savings Plan for investing in United States Savings Bonds.

This is all you do. Go to your company's pay office, choose the amount you want to save—a couple of dollars a payday, or as much as you wish. That money will be set aside for you before you even draw your pay. And automatically invested in Series E Savings Bonds which are turned over to you.

If you can save only $3.75 a week on the Plan, in 9 years and 8 months you will have $2,137.30. If you can save as much as $18.75 a week, 9 years and 8 months will bring you $10,700!

For your sake, and your family's, too, how about signing up today?

WATER & SEWAGE WORKS

Keys to efficient production

Frequently the keys to more efficient production are found in more reliable chemicals.

This is one reason why more and more users of chemicals are turning to Niagara.

a case in point...

NIALK LIQUID CHLORINE: Known for many years for highest quality and uniformity, NIALK Liquid Chlorine is increasingly important today as a dependable, economical means to more effective water purification and sewage disposal.

NIALK Liquid Chlorine was the first to be produced in commercial quantities. Niagara Alkali also originated the first successful equipment for feeding liquid chlorine into water.

NIAGARA ALKALI COMPANY

60 East 42nd Street, New York 17, New York

Nialk

LIQUID CHLORINE
CAUSTIC POTASH
CARBONATE OF POTASH
PARADICHLOROBENZENE
CAUSTIC SODA
TRICHLORethylene

NIAGATHAL (TETRACHLORO PHTHALIC ANHYDRIDE)

G-E LIMITAMP controls the operation of high-voltage motor drives up to 2250 hp . . . gives you quick, silent protection for personnel and equipment against dangerous short-circuit conditions up to 250,000 kva . . . helps prevent costly shutdowns.

Safety for your personnel and equipment with high-voltage G-E Limitamp Control

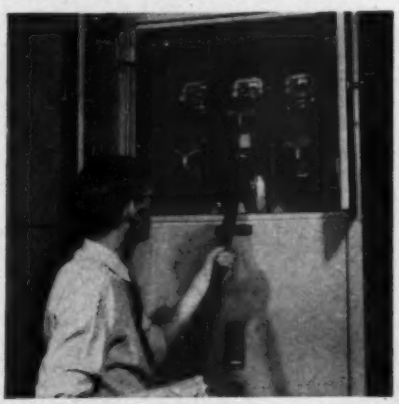
Don't take chances with dangerous short-circuit conditions. G-E Limitamp Control protects against sudden electrical overloads . . . assures greater safety for your personnel and costly electrical equipment. A high-voltage motor control, G-E Limitamp Control provides interrupting capacity up to 250,000 kva.

MAINTENANCE PERSONNEL is guarded by a steel barrier separating high- and low-voltage compartments. A mechanical door interlock assures motor circuit interruption before the fuse compartment door can be opened.

GET EQUIPMENT PROTECTION with General Electric Type EJ-2 fuses which clear fault current in less than ¼ cycle, operate only under actual "short" conditions. Also, improved heavy-duty air-break contactors give you millions of operations.

FOR YOUR SPECIAL OPERATION individual components need not be specified. Let G-E application engineers select the correct components, give you the right interrupting capacity . . . better personnel and equipment safety.

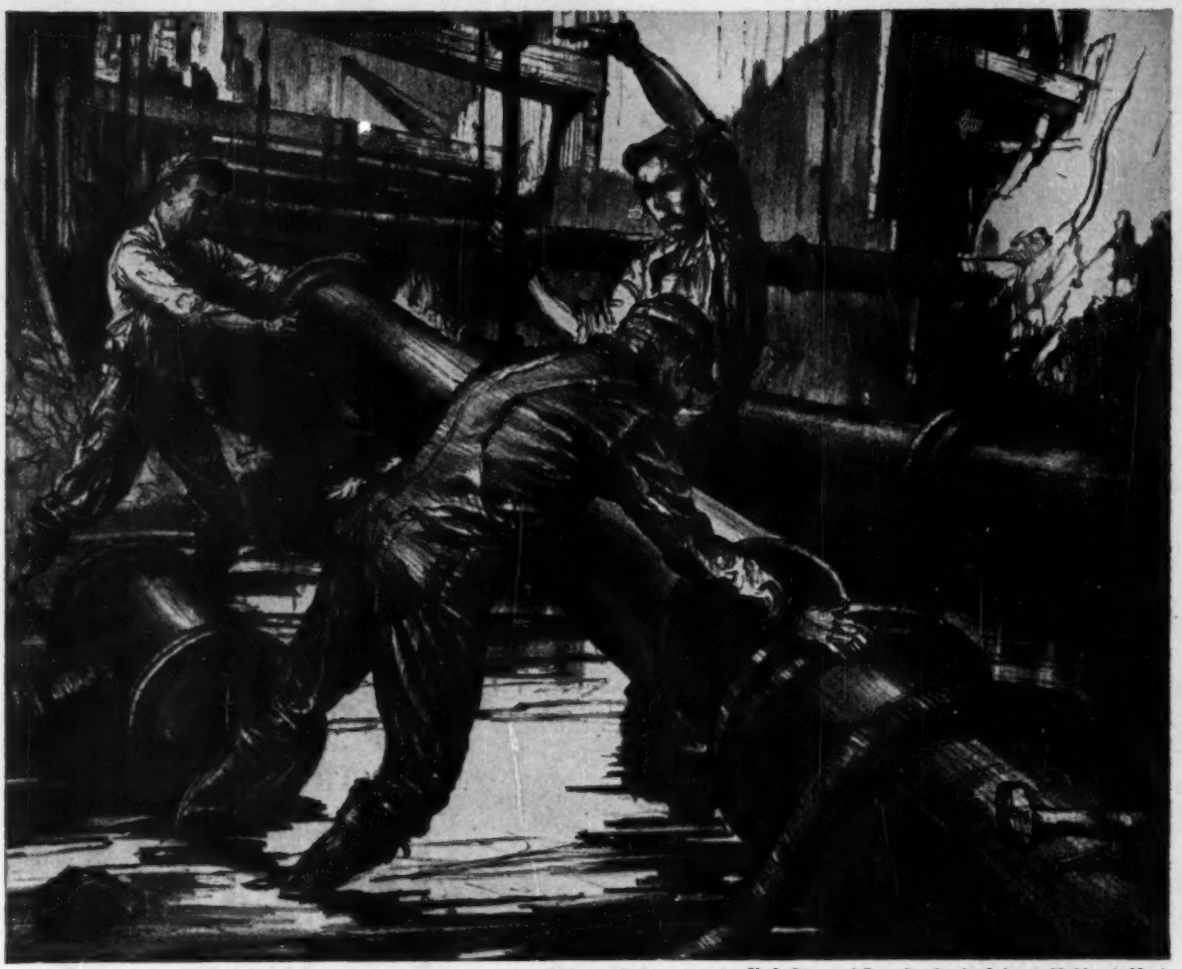
FOR COMPLETE INFORMATION about G-E Limitamp Control, contact your nearest G-E Apparatus Sales Office, or write to Section 781-7 for Bulletin GEA-5409 today. General Electric Company, Schenectady 5, N. Y.



MAINTENANCE IS EASY . . . Fuses swing forward on hinges for the disconnect position and fuses can be quickly lifted out.

You can put your confidence in—

GENERAL ELECTRIC



Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A. N. A.

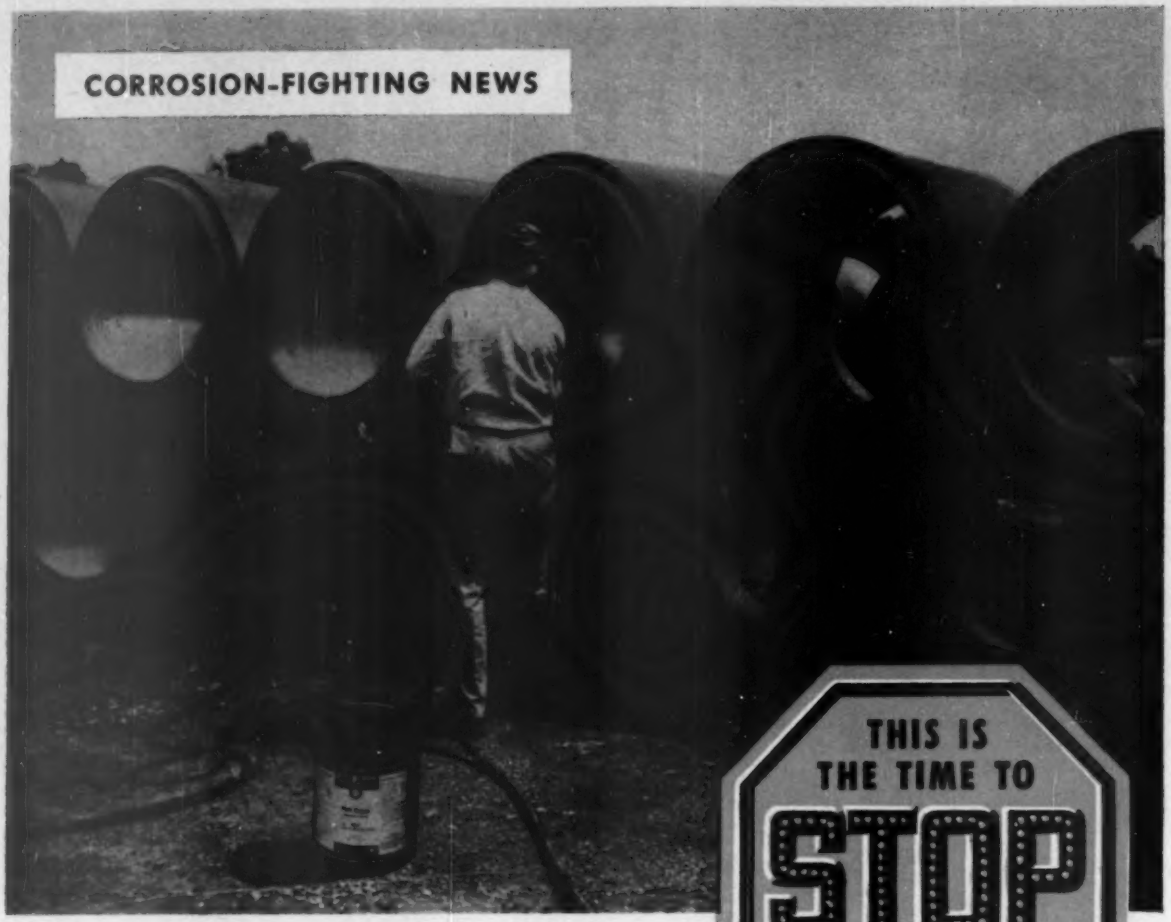
CAST IRON PIPE is a versatile pipe. It has age-old and outstanding service records in water, gas and sewerage fields.

Today's U. S. cast iron pipe centrifugally cast in metal molds combines the long life characteristics of the older type of pipe with all the advantages gained through the use of a modern manufacturing process and rigid quality controls.

Whether your requirements call for centrifugally cast iron pipe in sizes 2- to 24-inch, pit cast pipe in the larger sizes or fittings—all with various types of joints and in accordance with standard specifications—we are in an excellent position to meet them promptly from our five strategically located plants.

U.S. PIPE

United States Pipe and Foundry Co.,
General Office, 3300 First Ave., N. • Birmingham 2, Ala.
Plants and Sales Offices Throughout the U. S. A.



There's only one sensible way to fight sewage corrosion: Stop it before it starts. Coating your pipe, tanks and equipment with *Pitt Chem* Tar Base Coatings before you put your plant into operation is like buying an insurance policy against corrosion problems for many years to come. Pitt Chem offers you three outstanding benefits:

1. **Longer-lasting protection.** Pitt Chem stands up to sewage corrosion 7 to 10 years longer than ordinary paints. Yet it costs no more per gallon.
2. **Economical application.** No special paint crew is required. Your own men can apply coating after a few simple instructions.
3. **Durable Bond to most materials.** Pitt Chem forms an excellent long-lasting bond with metal, masonry, cement and stone.

Add up these unique benefits and you'll agree: *No other material does such a complete job of protection at so little cost.* ● A *Pitt Chem* corrosion control booklet will gladly be sent to you on request.

W&O 4958

PITT CHEM 101—For Severest Conditions
PITT CHEM 102—Maintenance Coating
PITT CHEM 103—General Purpose Coating
PITT CHEM 104—Potable Water Service
PITT CHEM 105 AQUATAR—A Water Dispersion
PITT CHEM 106 TARMASTIC—Sealing Compound
PITT CHEM 107 PACHKOTE—Specialty Coating
PITT CHEM 110—Specialty Coating

PROTECTIVE COATINGS DIVISION
PITTSBURGH
COKE & CHEMICAL CO.
Grant Building • Pittsburgh 19, Pa.

COAL CHEMICALS • AGRICULTURAL CHEMICALS • FINE CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

MUELLER

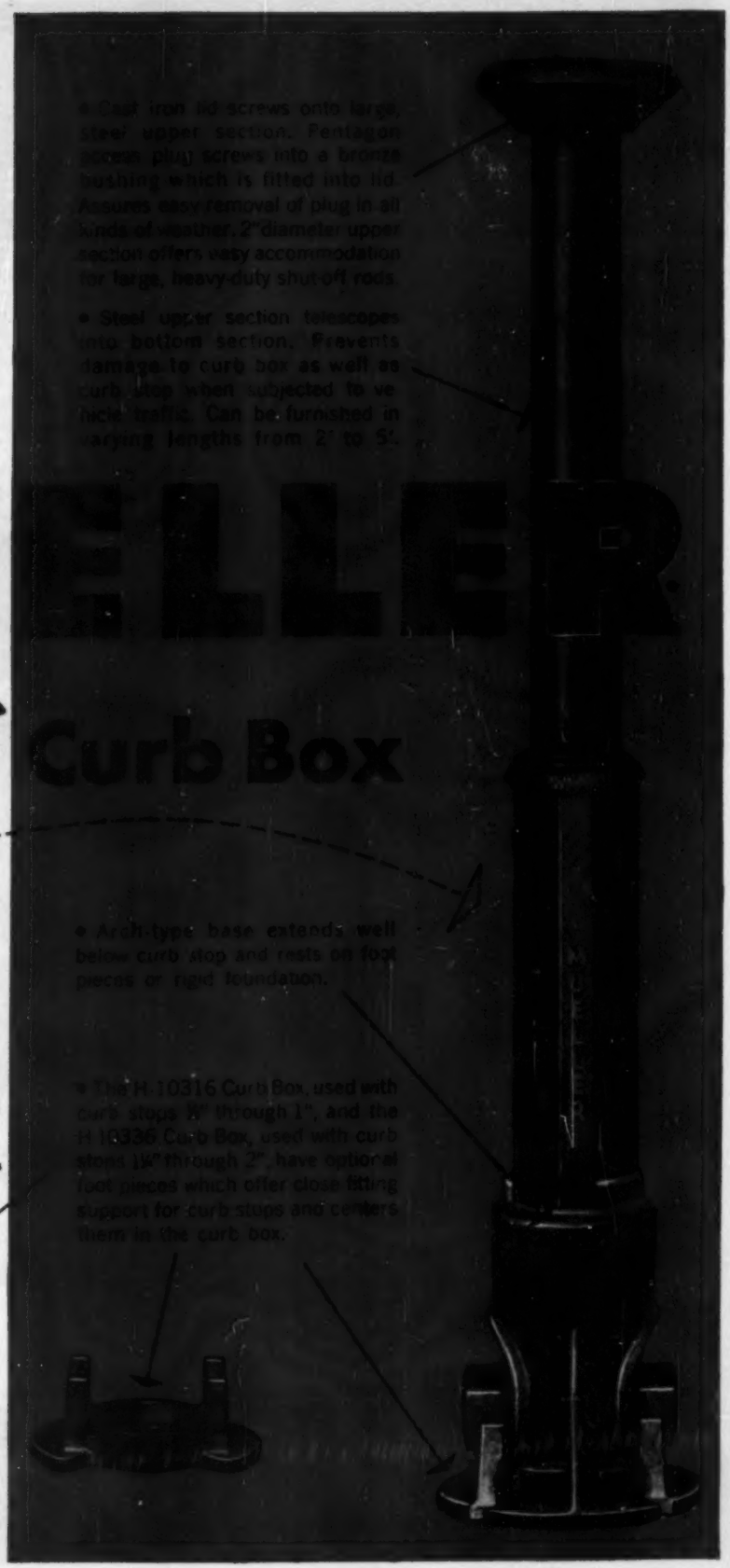
Improved Curb Box

• Cast iron lid screws onto large, steel upper section. Pentagon access plug screws into a bronze bushing which is fitted into lid. Assures easy removal of plug in all kinds of weather. 2" diameter upper section offers easy accommodation for large, heavy-duty shut-off rods.

• Steel upper section telescopes into bottom section. Prevents damage to curb box as well as curb stop when subjected to vehicle traffic. Can be furnished in varying lengths from 2' to 5'.

• Arch-type base extends well below curb stop and rests on foot pieces or rigid foundation.

• The H-10316 Curb Box, used with curb stops ⅝" through 1", and the H-10336 Curb Box, used with curb stops 1¼" through 2", have optional foot pieces which offer close fitting support for curb stops and centers them in the curb box.



Contact your Mueller representative or write direct for detailed information.

MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

THE MEMBERSHIP OF A C.I.P. Century Club

CAST IRON PIPE

DISTINGUISHED CLUB...
now has 60 Members!

The Cast Iron Pipe Century Club is probably the most unusual club in the world. Membership is limited to municipal, or privately-owned, water and gas supply systems having cast iron mains in service for a century or more. Although the Club is formally constituted, there are no dues, no regular meetings, and no obligations other than to inform the Recording Secretary if and when the qualifying water or gas main is taken out of service, or, sold for re-use.

In spite of the unique requirement for membership, the Club roster grows, year by year, from 18 in 1947 to 60 in 1954. And why not, when a survey sponsored by three water works associations, indicates that 96% of all 6-inch and larger cast iron water mains ever laid in 25 representative cities are still in service. And when answers to a questionnaire, mailed to gas officials in 43 large cities, show that *original* cast iron mains are still in service in 29 of the cities.

If your records show a cast iron main in service, laid a century or more ago, the Club invites you to send for a handsome framed Certificate of Honorary Membership. Address Thomas F. Wolfe, Recording Secretary, Cast Iron Pipe Century Club, Peoples Gas Bldg., Chicago 3, Illinois.

CLUB ROSTER

DEPARTMENT OF WATER AND WATER SUPPLY
City of Albany, New York
NIAGARA MOHAWK POWER CORP. (GAS)
Albany, New York
ALEXANDRIA WATER COMPANY
Alexandria, Virginia
BUREAU OF WATER, DEPT. OF PUBLIC WORKS
Baltimore, Maryland
CONSOLIDATED GAS ELECTRIC LIGHT AND POWER CO
Baltimore, Maryland
PUBLIC WORKS DEPT., WATER DIVISION
Boston, Massachusetts
BOSTON CONSOLIDATED GAS CO.
Boston, Massachusetts
PUBLIC SERVICE ELECTRIC & GAS CO.
Bound Brook, N. J.
BRIDGEPORT GAS LIGHT COMPANY
Bridgeport, Conn.
DEPARTMENT OF PUBLIC WORKS, DIVISION OF WATER
Buffalo, New York
SOUTH CAROLINA ELECTRIC & GAS CO.
Charleston, S. C.
PEOPLES GAS LIGHT & COKE COMPANY
Chicago, Ill.
WATER WORKS DEPARTMENT
Chicago, Ill.
BOARD OF WATER COMMISSIONERS
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MICHIGAN CONSOLIDATED GAS CO.
Detroit, Michigan
FALL RIVER GAS WORKS COMPANY
Fall River, Massachusetts
CITY OF FREDERICK WATER DEPT.
Frederick, Maryland
GAS DEPARTMENT
City of Fredericksburg, Virginia
PUBLIC SERVICE COMMISSION
City of Halifax, N. S., Public Water Supply
THE HARTFORD GAS COMPANY
Hartford, Connecticut
MUNICIPAL WATER WORKS
Huntsville, Alabama
BUREAU OF WATER
Lancaster, Pennsylvania
LOUISVILLE GAS & ELECTRIC CO.
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Lynchburg, Virginia
NATURAL GAS SERVICE, INC.
Madison, Indiana
MOBILE GAS SERVICE CORP.
Mobile, Alabama
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Mobile, Alabama
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New Haven, Conn.
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CITY OF WHEELING WATER DEPT.
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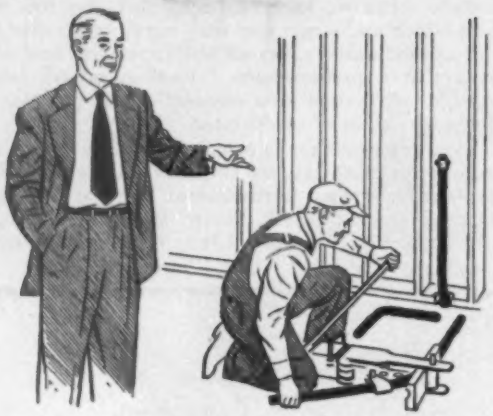
SERVES FOR CENTURIES

The LONGER LIFE of WROUGHT IRON PIPE

proves...



It costs less to do it right

—than to do it over!

When you specify pipe there are two things well worth remembering—

1. When you install it, you pay only the pipe fitter,

but

2. Every time you repair it, you pay pipe fitter, carpenter, mason, plasterer, and painter.

This dollars-and-cents difference underscores the fallacy that low-first-cost materials are the answer to piping economy. And these same facts provide a yardstick that places the economy emphasis where it rightly belongs . . . on PIPE SERVICE LIFE. The longer service life of wrought iron pipe has proved to thousands of users that it costs less to do it right than to do it over. In installation after installation, wrought iron pipe has doubled, tripled, and even quadrupled the useful life previously obtained from low-first-cost piping. These users have discovered that although you pay a little more for wrought iron, you pay a LOT LESS FOR MAINTENANCE. Wrought iron gives you piping economy because it lasts longer, at lower cost per year.

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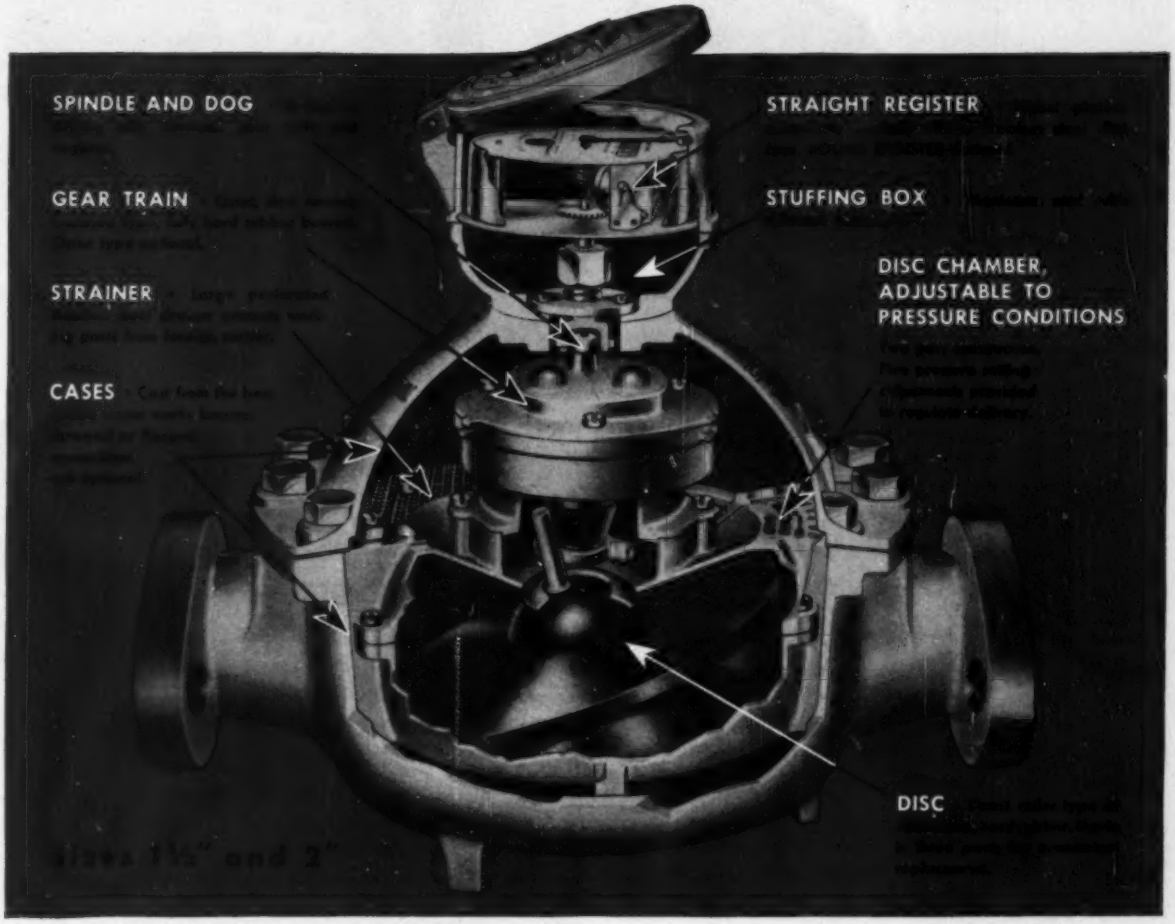

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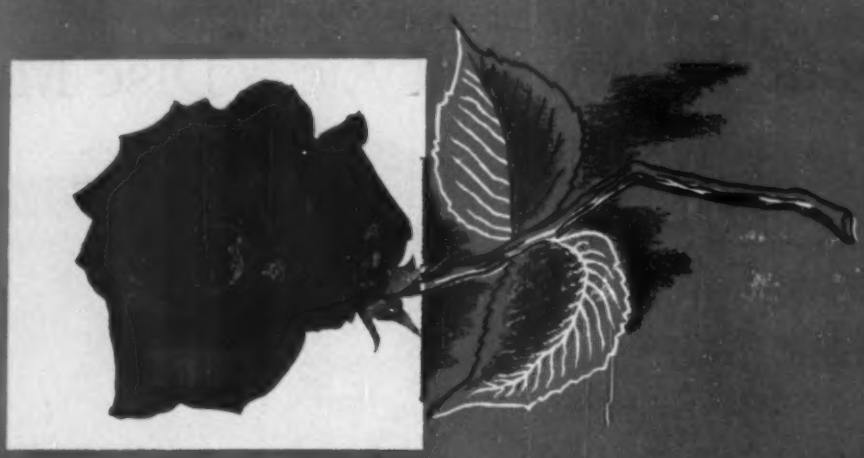

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"What's in a name? That which we call a rose
By any other name would smell as sweet."

Romeo and Juliet. Act II, Sc. 1.

What's in a name? We like to feel that there is a lot in the name "Welsbach". That after 75 years it stands for integrity . . . for fair dealing . . . for quality in service and product . . . and for true dependability. What's more we believe that the people we do business with feel that way about "Welsbach".

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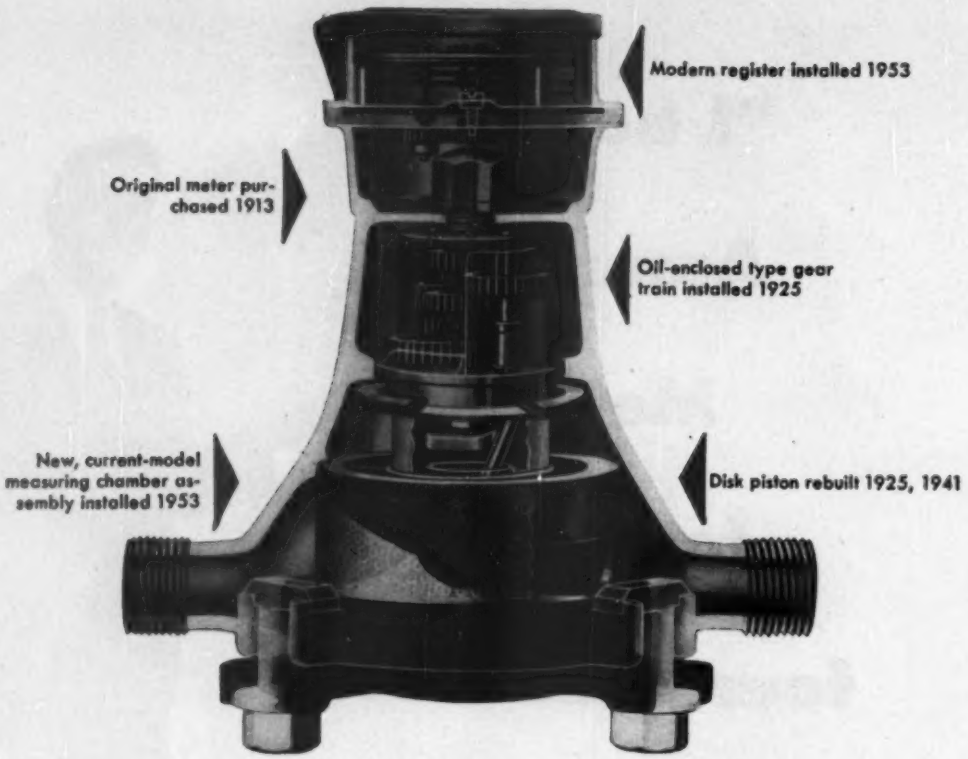
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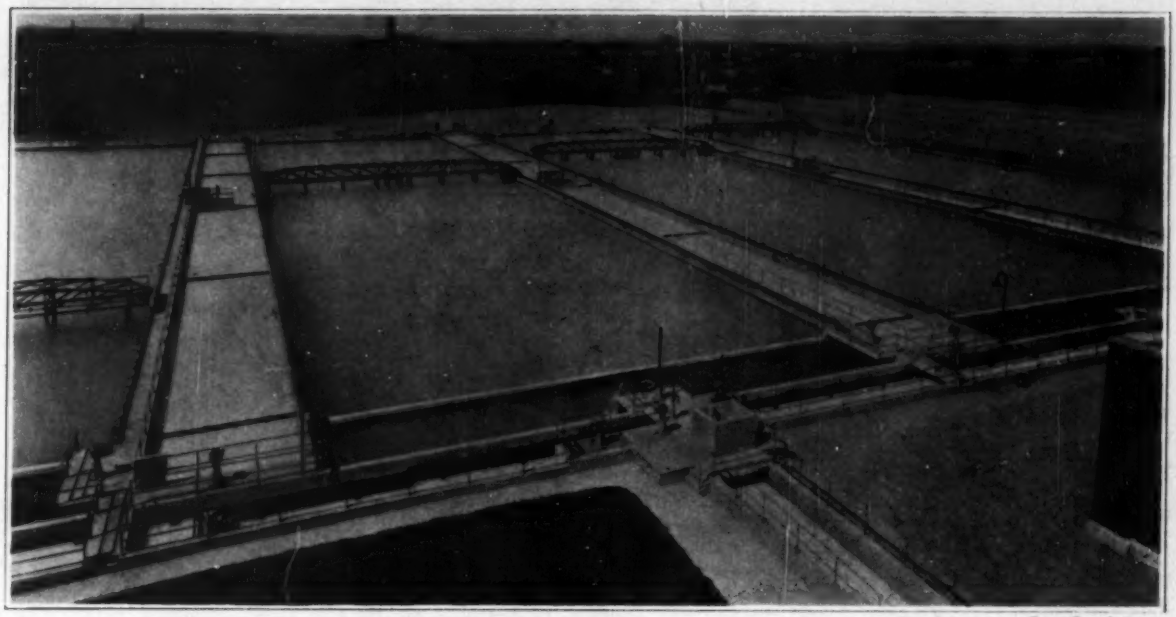
VOL. 101, NO. 1 JANUARY 1954

WATER & SEWAGE WORKS



Dorr Co. photo

NEW 96 mgd well water softening plant in service at Dayton, Ohio

Water Supply Developments During the Year 1953

A Review of Progress and Trends in the Field

by **MORRISON B. CUNNINGHAM,*** ***President, American Water Works Assn.***
Oklahoma City, Okla.

MUCH progress can be reported on developments in the field of water supply during 1953, but it is also evident that many problems remain unsolved. We cannot be complacent. We must recognize that future needs in the field will be great. We must continue to seek better ways of solving our problems, and we must apply ever-broadening concepts in our practices.

Many Problems—Few Answers

Water and water supply were important considerations in the Mid-Century Conference on Resources for the Future at a three-day meeting in Washington last December. Attending were more than 1200 representatives and observers comprising a broad cross-section of persons and individuals in the field of natural resources. Resources for the Future, a private corporation fostering research and education in this field, conducted the conference with the aid of a grant from the Ford Foundation.

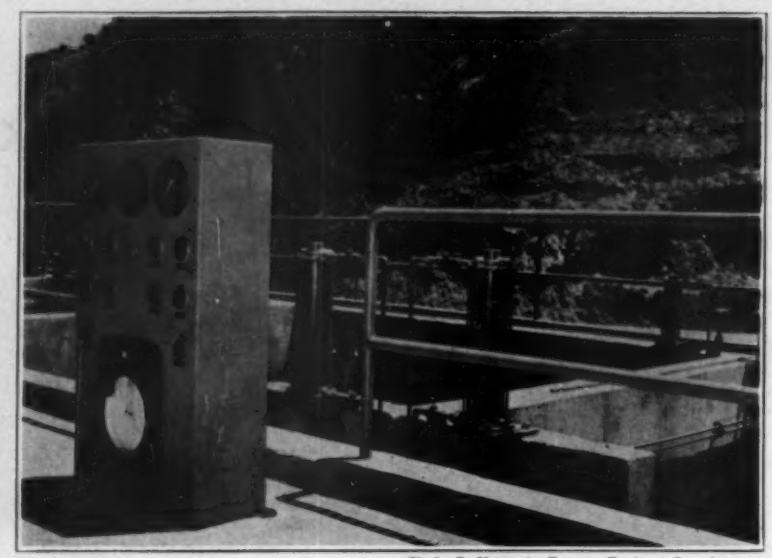
More than 200 individuals attended the sessions of Section III titled "Water Resource Problems". The water works viewpoint was strongly represented on the "Steering Committee" of the section (nine members): Co-chairman was Abel Wolman, Professor of San. Eng., Johns Hopkins Univ., Baltimore, Md.; and members were Samuel B. Morris, Genl. Mgr. and Chief Engr., Dept. of Water and Sewer, Los Angeles; W. W. Horner, Cons. Engr., St. Louis; and Warren T. Hannum, Chmn., California State Water Polln. Control Board.

The section concentrated its attention on three broad areas of study which must be given more detailed attention in the future. These are: A. The supply, use, and competitive demands for water; B. The division of responsibilities for water resources; and C. The principles of evaluation and reimbursement of water resources projects. In the discussions, many issues and many specific situations were reviewed with critical comment.

*Superintendent and Engineer, Water and Sewage Dept., Oklahoma City, Okla.

Chicago Bridge & Iron Co. photo

New Smyrna Beach, Fla.—100,000 gal.
Watersphere, 125-ft. to bottom.



Clyde C. Kennedy Engrs., Foxboro Co. photo

North Marin County Water District, Novato, Calif.—Instrumentation for filter control
Included are air switches operating on-off valves and a dual control system.

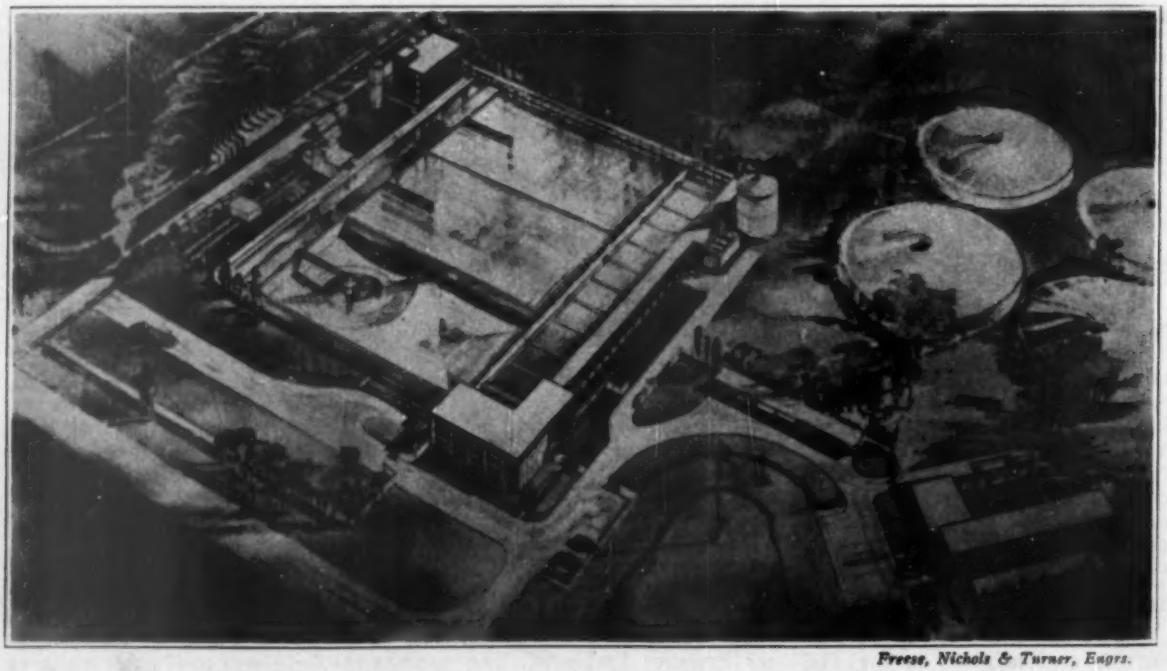
The Conference will work to point the way toward better uses and more effective conservation of our water resources.

Works Construction Progress

The first 50 weeks of 1953 showed an increase of 9 per cent in water works projects constructed, over a similar period for 1952. The cost of these projects increased, during the same period, from $216,400,000 to $234,900,000.

This past year also saw the removal of many construction materials from the critical N.P.A. list, which may be a contributing factor in the 9 per cent increase. Official controls on meter specifications (AWWA C700, C701, C702, C703, C704) rescinded, and Controlled Materials Plan Regulations 1, 3, 4, and 6 revoked during 1953.

These facts, plus the tremendous backlog of needed facilities, and the high interest currently reported by the Federal government in the constantly increasing need of water treatment and pollution control activities, seem to indicate that the water works industry should enjoy an extended period of substantial improvements.



Freese, Nichols & Turner, Engrs.

Houston, Texas—New 33 mgd purification plant starts with three clarifiers and twelve filter units
Drawing shows chemical building at top corner of clarifiers, wash water tank at upper end of row of filters, and administration building at lower end. At upper right are four ground water storage tanks.

In describing the expansion of the Colorado River aqueduct system of the Metropolitan Water District of Southern California, Diemer reported that present construction costs are about three times greater than 1933-39 costs for original identical features. Responsible officials wish that less strenuous efforts had been made 15 years ago to defer all possible items of construction in order to reduce the bond issue. The present expansion program, the major portion of which is planned for completion early in 1955, will cost $52 million. It will include two additional pump units at each of the five pumping plants; 125 miles of 30 to 72-in. distribution lines; and a 1,500-acre-ft. operating reservoir.

Johnston Pump Co. photo

Teheran, Iran—A 1000 gpm, 300 ft. lift pump in palace grounds of the Shah
Iranian officials were convinced of the successful use of ground water and contracted for 20 more pumps from the same firm.

New Treatment Plants

The new water softening plant built by Dayton, Ohio, overall capacity 96 mgd, is probably the largest well water softening plant in the world. Starting to soften water at this late date usually results in a major problem of financing for a city of such size. Consequently, in designing the plant, new ways were sought to reduce costs: Effective use was made of common wall construction to install four Flocculators (each in a basin 16 ft. wide by 350 ft. long) and four Monorake sludge scrappers (each in a 90 ft. by 330 ft. basin).

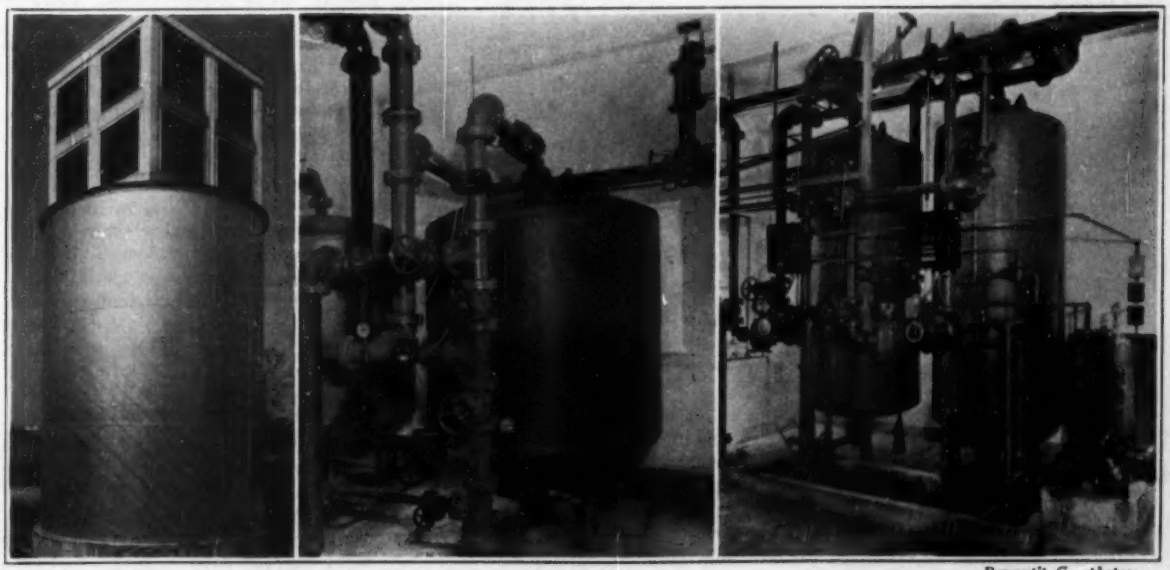
The new 50 mgd plant at Houston, Texas is initially equipped for 33 mgd and is designed to operate efficiently at 200 per cent of capacity. It is planned for continuous unit expansion to 200 mgd. A separate pump station operates in conjunction with the plant, delivering 75 mgd of untreated water to industries. More than one-half of the piping required in conventional pipe galleries has been eliminated in this plant by constructing the filters parallel to the discharge ends of the settling basins and using the intervening space as a two-story channel for treated water (above) and wash-water disposal (below). Rubber-lined butterfly gate valves were used on all large low pressure piping, saving $124,000 over the cost of gate valves. Construction cost of the plant was $5 million.

Another new filtration plant placed in service is that at Allentown, Pa., with a capacity of 20 mgd. This, with a new pumping station, supplements the existing 10 mgd treatment plant. See cover photograph of the beautiful interior of the new Allentown plant.

The new Norfolk, Va., plant is illustrated in photographs published with this article.

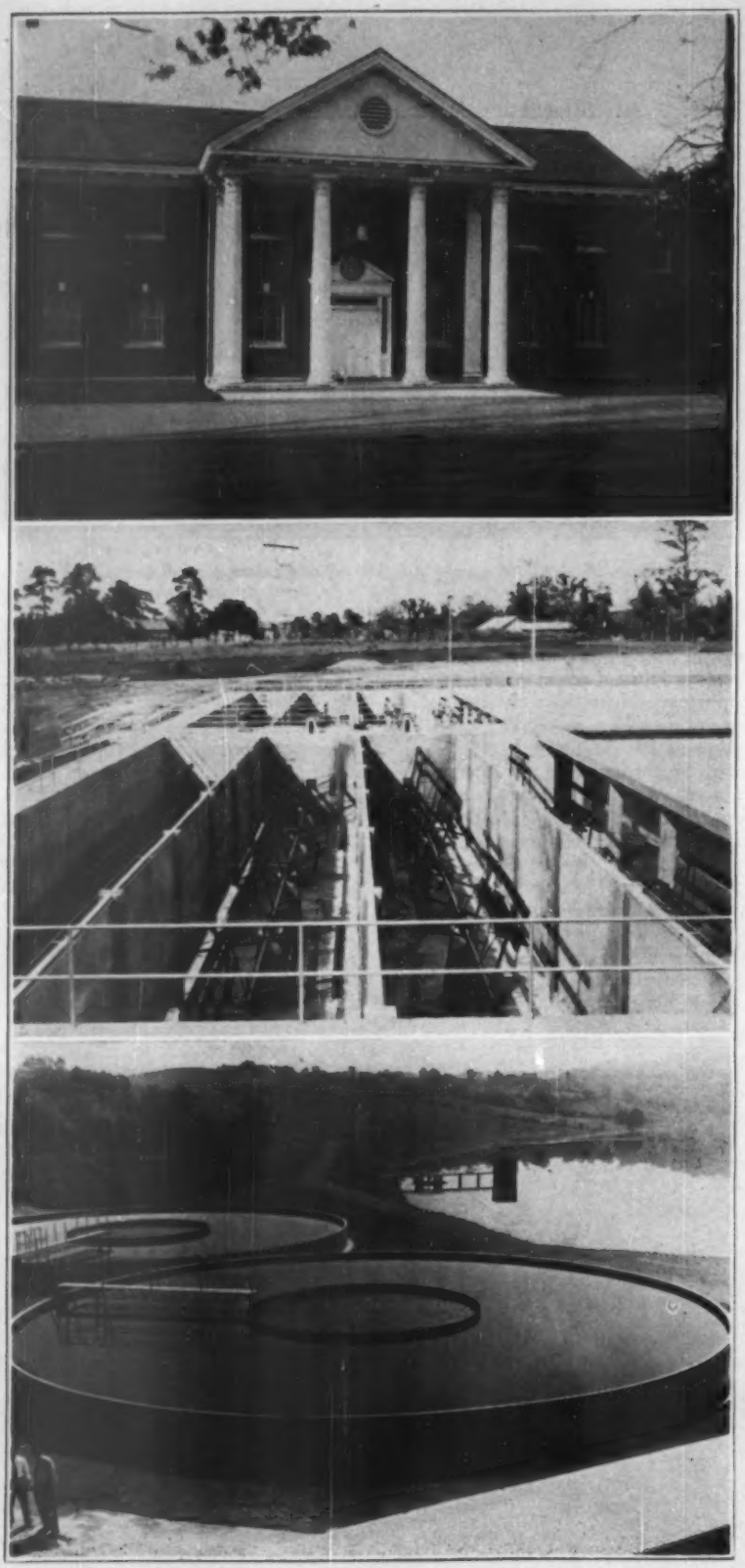
Miami's new 40 mgd southwest plant is not yet in operation, but is nearing completion.

A first report has been published by Wertz covering operating experiences, costs, maintenance, and repair of the three-year-old Miami Lime Reclama-



Permutit Co. photos

Martinsville, Ill.—Complex treatment can be provided even for small supplies
This municipal supply, from wells, is treated by coke-tray aeration, pressure sand filters, and automatic softening units.



NEW OUTSIDE—Norfolk, Va., water treatment plant. (Top, Builders-Providence Co.) Macon, Ga.—Flocculating units in new plant. (Center, Amer. Well Works Co.) Greensburgh, Pa.—Two of four steel settling units. (Bottom, Hammond Iron Works.)

tion plant. Results obtained have been most satisfactory and show that a worthwhile saving in cost of water treatment is being effected by using the reclaimed lime.

River Basin Projects

Management of Missouri Basin projects has been described by Maffitt. The Council of State Governments, in 1953, published a revised draft of a compact proposed. It recommended further study of using the compact approach in the Basin's development.

Flood protection in the Kansas River Basin was reported on by a board of engineers, Messrs. Veatch, Howson and Wolman, engaged to review and analyze plans for the reduction of flood discharges in this Basin. The board has also been authorized to prepare and submit flood protection plans for engineering and economic consideration.

Water Quality Yardsticks

Laboratory authorities have continued to evaluate bacteriological procedures for measuring the sanitary quality of water. Mallman has reported on studies which show the present coliform test to be a satisfactory method of measuring the bacterial safety of water supplies. At the same time, he reports the use of fecal type coliform organisms for measuring sanitary quality to be not applicable as yet, owing to the lack of a satisfactory method of identification. For estimating the sanitary quality of rural water supplies, he considers a new yardstick to be needed.

In a discussion, Gilcreas points to the possible presence of infective agents other than those causing typhoid fever and similar enteric diseases—such agents are not revealed by current standard bacteriological methods. He reported that studies have been undertaken to determine the presence and relative rates of survival of virus pollution in water.

In commenting on the coliform test, Levine discusses "the principle of attainability" in setting water standards based on the coliform index. He points to the needs for reevaluating the sanitary significance of the coliform group of bacteria, and for a search for other indexes to supplement or replace the coliform index.

Reports on Membrane Filters

During the year 1953, certain methods have been improved which may assure the production of water of higher bacteriological quality.

It would be proper to cite first the work that has been continued by Goetz at the California Institute of Technology in respect to the use of the

American made membrane filter. This filter has been given the trade name "Millipore Filter MF". The procedures which he has described, as well as those reported from the research recently completed by members of the staff of the Lovell Chemical Company, are valuable contributions to laboratory technique.

Membrane filters may be employed for rapidly testing water from any part of a distribution system. Precise methods for the detection of bacterial contaminated water may become available so that determinations can be made before the water in the distribution system has been consumed.

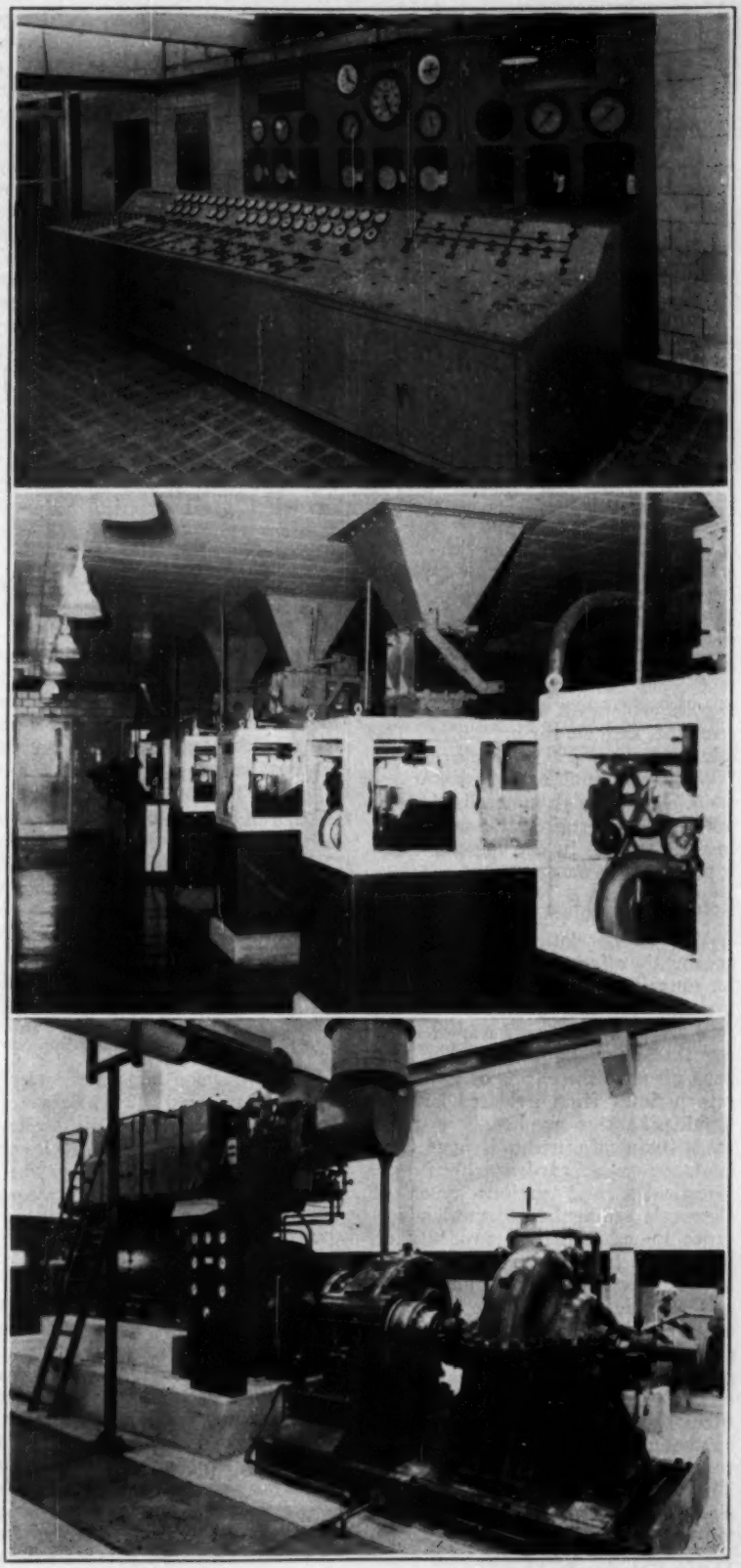
The technique of using the MF membranes for bacteriological examination of water has been the subject of a comprehensive report by a Task Group of the AWWA. This summarizes the present status of investigation work and outlines recommended procedures. The report discusses apparatus and materials, culture media, handling of samples, filtration (including the new "Concentrometer"), incubation, counting, and preservation of membranes.

Four genera of actinomycetes were identified by Silvey and Roach in studies of the Oklahoma City water supply. They explained the intense taste and odor problems—which has occurred in this supply during midwinter—as due to the disintegration and solution of the actinomycete by-products.

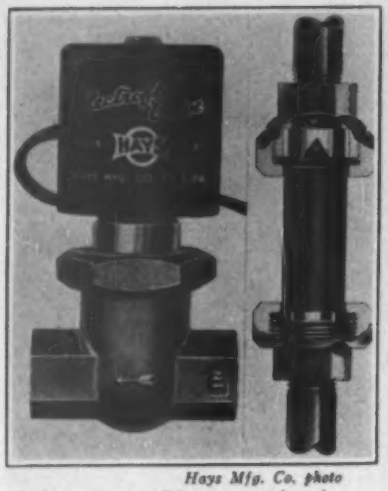
Ion Exchange Resins and Membrane Exchangers

Areas of the southwest and the far west continuously suffer from a sparcity of surface water. When rivers having high mineral contents are impounded, excessive evaporation results in high concentrations of undesirable cations and anions. There are areas in America that would develop industrially, agriculturally and sociologically, if there was some means of providing ample quantities of usable water.

During the past year or two, considerable advance has been made in the application of ion-exchange for the treatment of water supplies. The new products include cation exchange resins, as well as anion exchange resins of the weak and strong basic types. In addition, Ionics Incorporated in Cambridge, Massachusetts, has been working very effectively on membrane exchange devices which have as their purpose the removal of certain types of cations and/or anions. The advance that has been recorded for both types of products has been most encouraging. Brackish waters have been effectively treated in the



NEW INSIDE—Memphis Tenn., controls for 42 pumps. (Top, General Electric Co.) Norfolk, Va.—Gravimetric feeders in chemical bldg. (Center, Omega Machine Co.) Miami, Fla.—Standby power; 850 hp Diesel engine. (Bottom, Worthington Co.)



Hays Mfg. Co. photo

Water Savers—Pilot operated valve (maximum flow at minimum cost) and supply line rate controller

arid areas of the Middle East applying nepton membranes for the process of de-mineralization. It is possible that newer developments, either in the field of ion-exchange resins or with simplified types of membranes similar to nepton, will result in economical systems of demineralizing water. The advancement in 1953, therefore, gives hopes to communities and areas where there is ample high mineralized water and to sea-side regions that are limited in their activity by the sparcity of all types of fresh water.

Return of Irrigation Water

Very meager data are available concerning the effect of irrigation projects on municipal water supplies. It was brought to the attention of the A.W.W.A. at the Grand Rapids meeting that only slight study has ever been given to the effects of minimum return flows from irrigated land on municipal water supplies. Stored water is frequently used to irrigate farm lands or truck gardens. Fertilizers, insecticides, and various types of chemicals are applied to the lands in order to enhance their productivity. From time to time, rainfall or excess irrigation water eludes the minerals and chemicals from the irrigated areas, causing them to flow into source streams serving municipal water supplies. Moreover, the problem of insecticides, excess plankton blooms, unusual tastes and odors, and highly contaminated raw water should be considered in the irrigation problem. The idea of investigating this field was a direct step toward protection of the water supplies of the nation.

Liquid Chlorine Problems

Of specific value in safety training programs is a series of practical articles published in *Water & Sewage Works* by Langworthy on "Fundamental Principles of Handling Chlorine". He summarizes useful information and describes good practices most valuable to all users of chlorine.

The Joint Committee on Chlorine Supply published a detailed and documented report titled "Recommended Procedures in the Use of Liquid Chlorine at Water and Sewage Plants". This committee includes representatives of the Conf. of State Sanitary Engineers, the Federation of Sewage and Industrial Wastes Assn., the American Water Works Assn., and the U.S. Public Health Service. The report is designed to standardize procedures, such as proper container size for use, suitable inventory, schedule of container return, etc. This publication is of great practical value to engineers and operators as well as to chlorine producers.

The bulk storage of liquid chlorine is a new consideration in the sanitary field. Woodard and Hedgepeth have described the technical considerations applicable to this practice. They cite experiences and reliable information, but recommend a comprehensive engineering study and review to precede each installation.

Tampa, Fla., during 1953 became the first city in North America to install facilities for bulk storage of liquid chlorine at its water treatment plant. This step in the handling of liquid chlorine provides a greater economy and insures an adequate supply. (The first sewage treatment plants to install bulk storage of liquid chlorine are those at San Francisco, Calif., as reported in the October issue of *Water & Sewage Works.*)

The San Diego aqueduct capacity has been restored by chlorination. Streicher has reported on the development of this treatment in which continuous application has now been supplanted by more economical programmed chlorine application.

Relocation of Water Mains

The trend has continued toward radical and extensive improvement of state and federal highway systems in urban areas. In general, the policy has been to force water utilities to relocate and adjust mains and facilities at their own expense—without aid or cooperation from the agency sponsoring the highway improvement. Frequently the highway construction causes the water utility extreme hardship, financial and otherwise.

Some definite action is needed, by Congress and by state legislative bodies, to require that expenses incurred in relocation of water utilities should be borne by or shared by the highway improvement authorities.

Natl. Water Main Cleaning photo

Pipe Savers—New hydraulic ram to insert large cleaning machines into mains easily and quickly.

Water Use by Industry

The immense extent of water use by industry is not generally recognized. An extremely useful job to collect information in this field and to develop consumption requirements has been undertaken by a task group of the AWWA, H. E. Hudson, Jr., Chairman, and a report has been published in the AWWA Journal. Estimated distribution of water use in the U.S. as of 1950 is cited, and the report states that it seems probable nearly half of the water supplied by public systems goes to industrial users:

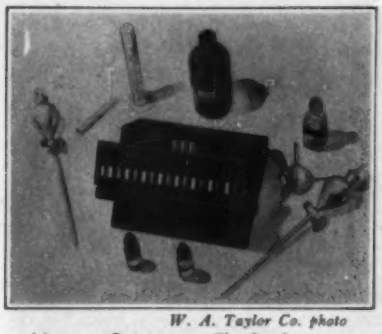
	Daily Consumption in billion gal.
Municipal (public)	14
Industrial (private)	81
Rural (farmstead)	5
Irrigation	100

Water works men thus find themselves among the minority in water use. This does not mean that public supply is of minor importance, for most water rights doctrines accord it priority over other water uses.

There is need for the development of conservation practices in water supply work for industry. The task group considers that a useful service can be provided by reporting information on projects in progress which involve measures such as substituting water of less desirable quality and using various types of conservation equipment.

Data on Water Metering

The program of complete metering in Ottawa, Ont., will require two years, according to a report by W. E. MacDonald, Commr. of Water



W. A. Taylor Co. photo

Measures Detergents—The Syndet comparator devised to determine the synthetic detergent content of sewages by colorimetric comparison. Outfit includes all reagents and accessories.

Works. Meter sizes range from ⅝-in. to 8-in. for the city's 37,840 services. Total costs are: $1,198,430; less cost of metering five services, not considered advisable, $48,430; and plus estimated cost of building extensions, testing equipment, trucks, office equipment, etc., $100,000; a final total cost of $1,250,000.

Water Practices Reviewed

A detailed fundamental review of water works practices is useful for all personnel in the field, and may provide essential basic information for the short school type of instruction. A valuable series of articles by Symons to serve this purpose is being published as a regular series in *Water & Sewage Works*.

Fluoridation planning and operating experience has been described in a number of papers presented at section meetings. A group of five such papers were published as a symposium in the March 1953 AWWA Journal, providing useful reference material for a variety of plant sizes and conditions.

The AWWA Journal, in its April 1953 issue, published four important papers on this subject: Bratton, on the food and beverage industry viewpoint; Weir, on a survey of industrial considerations; McKee, on milk as the vehicle; and Land and Mosenthal, a review of court decisions.

Operating Data Survey

The AWWA published, as a staff report, the results of a questionnaire on operating data for water works in 1950. Data were based on an approximately 50 per cent return from 900 water utilities serving populations of at least 10,000. Items covered in tabulations for 416 communities are: 1. Basic data; 2. Production and distribution data; 3. Financial Analysis; 4. Rate Analysis.

This report represents an unusually comprehensive and useful compilation of information.

Progress in Safety

During 1953, at the AWWA conference, four task groups assigned to study a safety program for the water works industry presented reports. Ample evidence has been cited to demonstrate that the water industry needs a safety program, that safety not only saves money but benefits the workers and the industry as well.

The four task groups are set up to study: (1) Supply safety; (2) treatment and pumping safety; (3) distribution safety; and (4) administration safety. Their reports constitute a comprehensive survey of accident causes and preventive methods in each aspect of water works safety. They should be studied and applied by all supervisory personnel.

Operators' Short Courses and Certification

Training courses for water works personnel are now to be found in almost every state in the union, and 23 states have certification programs; this was reported during 1953 by the AWWA committee on the status of training courses and certification. This committee has published data particularly useful to the conduct of short courses, special and extension courses, and on the certification of water works personnel. It recommends that short courses with higher educational prerequisites should be developed and that more emphasis should be placed on in-service training, and that certification (using uniform classifications) should be of the compulsory type. The benefits which result should include assurance of trained and responsible employees (to the utility), and adequate salaries and tenure (to the operators).

Quality of Public Supplies

The U.S. Geological Survey completed, during 1953, the publication of a series of nine separate "circulars" on the industrial utility of public water supplies. These provide brief information for water users on the ownership, source of supply, treatment processes, and storage facilities of the larger water systems of the U.S. during 1952, as well as detailed chemical analyses of both raw and finished waters. Until a consolidated report for the entire country is prepared, these circulars constitute the only comprehensive source of such data.

Better Tools and Techniques

Improved methods and equipment have been developed by the Los Angeles Dept. of Water to apply copper sulfate, continuously and intermittently, for algae control in open reservoirs. Use of these has resulted in great improvement in taste and odor quality throughout the system and, accordingly, a marked reduction in taste and odor complaints.

Fischer & Porter Co. photo

Measures Flows—Wide range test kit is portable. Five metering tubes with spherical constant-density floats designed for laboratory research and field flow checking work.

Weir has described the management tool—Cost Control—as applied to the water works industry. He recommends its application to establish proper prices and to watch production costs.

In the field of protective finishes in water works, Shankweiler has presented a detailed report on experience with chlorinated rubber coatings. These appear especially suited for service both as concrete and metal finishes—under conditions too severe for regular paints and enamels.

Maffitt has described the selection and operation of a postcard billing system for water and sewage utilities. Customer reaction is favorable.

Three unique types of water flow controls have been developed by Hays Manufacturing Company to reduce the waste of water in industrial applications. These devices may operate to the benefit of water utilities and provide a service to their consumers by analyzing water usage and providing water-saving units in process operations. The specialized devices are: (1) The "Mesurflo" control, using a flexible diaphragm on a fixed orifice, to deliver one set rate of flow regardless of variable inlet pressures; (2) the "Electroflo" valve for automatically turning the flow of water on or off by a piston operated solenoid valve; and (3) the "Shur-Flo" automatic interlock which controls liquid flow within 10 per cent of a predetermined flow rate by switching equipment on or off.

FAMED Poland hotel. Since 1845, bottled Poland water has been sold the world over.

The N.E.W.W.A. 72nd Convention at Poland Spring, Maine

A RECORD attendance of 615 members and guests registered at the 72nd Annual Convention of the New England Water Works Assn., last Sept. 27-30, taxed to the utmost the facilities of the Poland Spring House, Poland Spring, Maine. This meeting equalled or exceeded past high standards both of technical programs and social events.

Presidents

Retiring
Stanley M. Dore
Deputy Chief Engr.
Allegheny Co. San. Auth.
Pittsburgh, Pa.

Incoming
William B. Duffy
Superintendent
Public Works Dept.
North Andover, Mass.

Officers

Vice-President
Roger G. Oakman
Superintendent
Water & Sewer Div.
Needham, Mass.

Vice-President
Allan F. McAlary
Supt. & Treas.
C. & R. Water Co.
Rockland, Me.

New Officers

To head the association for the coming year, the following officers were elected:

President
Wm. B. Duffy
Supt. of Public Works
North Andover, Mass.

Sr. Vice-President
Roger G. Oakman
Supt. Water & Sewer Div.
Needham, Mass.

Jr. Vice-President
Allan F. McAlary
Supt. & Treas.
Camden & Rockland Water Co.
Rockland, Me.

Directors
Edw. L. Tracy
Director, Engineering Div.
Vt. State Dept. Health
Burlington, Vt.

Geo. G. Borgen
Weston & Sampson Engrs.
Boston, Mass.

Fred P. Stradling
Genl. Manager
County Water Co.
Bristol, R.I.

Treasurer
Wm. P. Melley
Comm. of Water
Milton, Mass.

Secretary
Joseph C. Knox
Secy, N.E. Pollution Comm.
Boston, Mass.

Editor
Geo. C. Houser
Editor, NEWWA Jour.
Brookline, Mass.

STANLEY M. DORE, Deputy Chief Engr., Allegheny County San. Auth., Pittsburgh, Pa., retiring president of the association, presided.

FRED E. SMITH, San. Engr., Cambridge, Mass., was chairman of the technical program committee.

STANLEY B. JOHNSON, Mueller Co., Boston, was chairman of the entertainment committee.

MRS. STANLEY M. DORE was honorary chairman, and MRS. DONALD C. CALDERWOOD was active chairman of the ladies' entertainment committee.

JOHN G. STEWART, Mgr. W. & S.W. Mgrs. Assn., New York, N.Y., was in charge of exhibits. The Water & Sewage Works Manufacturers Assn. sponsored three of the social events: the Harvest Barn Dance, the Social Hour, and the Manufacturers' Dinner.

Social Events

The social events during the convention began with an informal musicale and get-together presenting the first opportunity for meeting friends. From that evening through to the end of the program, days and evenings were busy indeed.

HARVEST barn dance night with favors, fun, and refreshments

Square dancers: (1) Charlie Baldwin, who called and directed; (2) Mr. & Mrs. Walter Hersey; (3) Mr. & Mrs. J. Elliott Hale; (4) Pres. & Mrs. Stanley M. Dore; (5) Vice Pres. & Mrs. William B. Duffy; (6) Secy. & Mrs. Joseph C. Knox; (7) Buffet table loaded with apples and cheese, doughnuts and cider.

On Monday evening there was an old-fashioned gala Harvest Barn Dance, with rural atmosphere, favors, and refreshments. On Tuesday noon there was a picnic in the Poland Spring pine grove; in the afternoon a golf tournament and a bus trip to visit the Bates Mfg. Co. (Bates Spreads), Lewiston, Me.; and in the evening professional entertainment with top-flight specialty acts.

On Wednesday there was a social hour and, following it, the manufacturers' dinner—the final event of the convention.

The Dexter Brackett Memorial Medal was awarded to HERMAN BURGI, JR., (Treas. and Genl. Mgr., Water District, Portland, Me.) for his paper on "Recent Construction by the Portland Water District."

The Commemorative Award, in memory of Professor Sedgwick, was presented to William A. Healy, Dir. Div. of San. Eng., State Dept. of Health, Concord, New Hampshire, for his paper on "Sanitary Control of Surface Water Supplies."

Twenty-five Year Award Certificates were presented to: Thurman W. Dix, Frank P. Morse, Thomas E. Sears, and Breton W. Vaughn.

Officers

Secretary
Joseph C. Knox
N. E. Interstate
Polln. Control Comm.
Boston, Mass.

Treasurer
William P. Melley
Commissioner
Water Dept.
Milton, Mass.

Comitteemen

Exhibits
John G. Stewart
Manager
Water & Sewage Mfrs. Assn.
New York, N. Y.

Technical Program
Fred E. Smith
San. Engr.
Munic. Dept. of Health
Cambridge, Mass.

Director
Edward L. Tracy
Dir., San. Eng.
State Dept. Health
Burlington, Vt.

Medallist
Herman Burgi, Jr.
Treas. & Gen'l Mgr.
Water District
Portland, Me.

Special events for the ladies included a tea and social hour, a tour of the Poland Spring properties, and a Bridge and Canasta party.

Awards and Honors

Highlights of the last evening, following the manufacturers' dinner, were the presentation of awards and the president's address.

Business Session

The Association's business session was devoted largely to the report of the committee on committees, to detailed progress reports by several committees to be continued, to a completed report by one committee, and to the establishment of one new committee.

For the committee on COST DATA FOR WATER MAINS AND SERVICES, Kenneth W. Robie, Chairman, presented a detailed and useful comparative report. Real interest in the subject was evident by a 69 per cent return to questionnaires (225 sent, 155 replies) which provided the data reported. The committee presented an analysis of information based on five groups of population in the communities. The data were reported by 19 private companies, 81 water departments, 26 public works departments, 27 water districts, and 1 metropolitan district. By population groups, replies were divided as follows: 67 under 10,000; 47 from 10,000 to 25,000; 20 from 25,000 to 50,000; 9 from 50,000 to 100,000; and 12 over 100,000. The 24 questions and answers summarized in the report gave excel-

PORCH sitters and informal discussors

Here and there the camera spots: (1) Chas. Hardy (Supt., Worcester, Mass.) and Herb Crowell (Rensselaer Valve Co.); (2) Leslie Hart (U. S. Pipe Co.) and Tom Wolfe (C. I. Pipe Res. Assn.); (3) Bill Sherwood (Hersey Mfg. Co.) and Dick Ellis (Factory Mutual Ins. Co.); (4) Mark Croker (Water Commr.) and Willard Pratt (Dir. Pub. Wks., Newton, Mass.); (5) Frank Wells (A. P. Smith Co.) and Mr. & Mrs. Ernest Tankard (Berlin, N. H.); (6) Mr. & Mrs. H. A. Galipeous (N. Adams, Mass.).

MORE items on the program

For relaxation, the putting green and the golf course. For information, the bus trip to Bates Mfg. Co., Lewiston, home of famous Bates Spreads.

lent coverage of the subject, as a few examples show:

2. *Kind of pipe used for ordinary services:*

Copper tubing	132
Wrought iron	9
Galvanized iron	4
W.I. or Galv. C.I.	41
Other (lead, plastic, brass)	10

4 and 5. *Average price and cost per lineal foot for services:*

Charge less than cost	38
Charge more than cost	15
Charge same as cost	29
No charge	14

The average charge per lineal foot was $1.11. Flat charges varied from $10.00 to $75.00, with an average of $41.00.

8. *Is pipe laid in trench with sewer and/or other utilities:*

Yes	52
No	81

17. *Are services laid to vacant lots or new streets when main is laid, to save future cuts in pavement:*

Yes	48
No	105

20. *How are mains financed in new developments:*

5% to 10% guarantee	41
City or town pays	27
Developer pays all	55
Charge/ft. $2.35 to $3.28	2
Developer labor, city materials	5
Company pays	3
Developer reimbursed	7
Developer and city 50-50	2
No policy	11

The associations' Executive Committee was requested to appoint a new committee to prepare a report on the cost of water main extensions, this to serve as a guide in individual instances.

For the new committee on RECREATIONAL USES OF PUBLIC WATER SUPPLIES, Clarence L. Ahlgren, committee member presented a progress report. It is planned to make a complete study of this problem to set limits, to determine the safety factor of chlorination, and to determine if proof of bacterial safety can be substituted for prevention. Mr. Ahlgren cited a pertinent legal case at Manchester, N.H., where the pressure of recreational interests led to public use of a lake (a source of public water supply). When the State Health Dept. approved the city's closing the lake to public use, the recreational interests brought legal action and the courts decided against the city. The only restricted area is now a limited vicinity around the water intake, but even this restriction is being fought.

Technical Program

Doubling Reservoir Capacity

"IMPROVEMENTS IN 1951 TO THE STORAGE RESERVOIR OF THE KENNEBEC WATER DISTRICT" were described in a paper presented by J. Elliott Hale, Superintendent, Kennebec Water District, Waterville, Me.

A small storage reservoir of about 2.25 mg capacity was constructed as a part of the original water system of Waterville in 1887. This served until 1918 when a new 22 mg reservoir was added at a higher elevation. Since 1945, considerable thought has been given to the need for additional storage capacity; demands have grown, and only 5 days supply is available with normal consumption.

It was finally decided to raise the concrete core wall in the earthen dam of the present reservoir about five feet, and to build dikes at portions of the reservoir needing such construction, to flow line 327 ft. and at an average distance of 50 ft. back from the lines of the present reservoir. This construction would provide a large increase in water area (about 18 mg), nearly equal to the original capacity.

Mr. Hale prepared plans and specifications for the work, the contract was let in March of 1951, work was started in July, and was completed in October of the same year.

Total cost of the entire project, including the general contract, guniting, 24-in. outlet pipe and gate, etc., was $51,737 or about $2,875 per million gallons of increased storage capacity. Mr. Hale's paper was illustrated with lantern slides and the procedures were described in detail.

The guniting operations appeared to be of special interest: this work was done by the Gunite Restoration Co., Malden, Mass. (total area 22,193 sq.ft.). The material was applied in 30-ft. sections, with 1-in. expansion joints filled with a special rubber base compound.

Old Conduit—New Pipe Line

"PORTLAND'S NEW SEBAGO LAKE INTAKE AND SUPPLY CONDUIT" was the topic described in a paper by Herman Burgi, Jr., Genl. Mgr. and Treasurer, Portland Water District, Portland, Me.

The water demand of Portland had increased beyond the capacity of its single transmission line and, in addition a leak had developed in the intake line: these factors made it essential to install a new intake in Sebago Lake and to build a new supply line. The old conduit, built in 1868, was inspected to determine its condition: considerable infiltration was found and the domed roof was dropped in several places.

Solution. To build a new conduit *within* the old one! (Note: The quality of brickwork in 1868 was so high that dynamite was required to remove some of it.) After a complete survey, a hydraulic study was made by Karl Kennison, and details were developed by Thomas Camp. Construction was started in May 1951.

The job included building a 60-in. intake line, a 3-unit screen chamber utilizing a Link-Belt traveling screen,

J. Elliott Hale
Superintendent
Kennebec Water Dist.
Waterville, Me.

Programmers
Brigham Britton
President
Carlon Products Co.
Cleveland, O.

Allen M. Symonds
Representative
Gen'l Eng. & Constr. Co.
Boston, Mass.

and the conduit. By building the conduit as a siphon through rock, a saving of about $500,000 was accomplished. Special 54-in. Lock Joint pipe was designed for 22-in. vacuum service. For air removal, vacuum pumps and a 12-in. air chamber were installed: thus, the full internal diameter of the pipe could be maintained. Buildings required included one for housing the vacuum pump with automatic electric controls; and a valve chamber, 6,000 feet distant from the lake. This new installation, especially the vacuum system, was tested in July, 1952, and provides a capacity of 80 mg at 22-in. vacuum.

MUSIC, magic, and make-up—an evening of entertainment
Under the make-up can you recognize: (1) Edwin Howard (Whitman and Howard, Boston); (2) George Wood (Commr., New Britain, Conn.); (3) Russell Babcock (Foxboro Co., Foxboro, Mass.)?

Maine Supplies Good Water

"MINERAL CHARACTERISTICS OF MAINE PUBLIC WATER SUPPLIES" were summarized in a paper presented by R. W. MacDonald, State Dept. of Health and Welfare, Augusta, Me. His report will provide a valuable reference when published—no brief review can give specific details.

Making Better Plastic Pipe

"MANUFACTURE OF PLASTIC PIPE" was most interestingly reviewed by Mr. Brigham Britton, President, Carlon Products Co., Cleveland, Ohio. He described the story of Carlon as the history of plastic pipe. Starting in 1939, when the first plastive extension machine was purchased, his firm worked for five years before successfully developing a plastic tubing of close enough tolerances to have feasible commercial applications.

In 1947, it was learned that a problem existed in pumping water from soft coal mines (for each ton of coal mined, seven tons of water must be pumped out). Steel pipe used for this purpose was corroded rapidly because of the sulfurous acid content of this water. Carlon made a polethylene plastic pipe and persuaded one coal company to use 2,000 feet of the product in each of three mines: after five years of use the original pipe was still in use, while steel pipe would have been replaced at least ten times. This successful application led to wide use of the plastic pipe in coal mines (even where no sulfur condition existed) because of its light weight and ease of installation in narrow, winding corridors.

During the late 1940's both steel and copper were in short supply, and this condition provided the opportunity for demonstrating the value of plastic pipe in farm and—eventually—public water supply systems. It has been stated that, in sizes under 2-in. diameter, plastic pipe sales are accounting for 20 per cent of total pipe footage sold.

Clarence I. Sterling, Jr.
Chief Engr.
Dept. of Pub. Health
Boston, Mass.

Programmers
Karl R. Kennison
Chief Engr.
Bd. of Water Supply
New York, N. Y.

Kenneth F. Knowlton
Supt.-Chemist
Salem-Beverly Supply
Beverly, Mass.

Mr. Britton described the extrusion of plastic pipe as a relatively simple operation involving feeding the proper plastic granules to a heated steel cylinder (300 to 600 degrees F), forcing the liquid plastic through a die, cooling it immediately by air and water, and continuously drawing it away by means of special pullers. Efficient operation of an extrusion plant requires running 24 hours a day. Further, freight rate is such a sizeable factor that one thousand miles has been determined as the limit for shipping pipe if the freight rate is to be absorbed; Carlon now operates five plants to produce the pipe at strategic locations.

The poor resistance of plastic pipe to ultra-violet rays is a serious drawback. Polyethylene, the basic ingredient of most plastic pipe, is particularly susceptible to the effect of sunshine. The dispersion of carbon black, to shade plastic particles, is the only known means of combating sunshine.

With the use of plastic pipe, the necessity arose for developing necessary fittings to use with it. Plastic fittings are made by an injection molding process, are rather inexpensive, but require a heavy investment in molds.

The flexible polyethylene pipe probably accounts for 80 per cent of the plastic pipe sold today. Pipe is also manufactured from acetate butyrate, styrene copolymer, and rigid poly-vinyl chloride materials—the latter two will play an increasingly important role because of their greater strength and resistance to acids and alkalies. They are, however, in the class of low pressure pipes. Much research is underway to make stronger plastic pipe (for example, by reinforcing with Fiberglas), so far not with much success. Mr. Britton reported research investment is necessary (Carlon has 40 competitors) and that progress is continuously being made. He predicted that plastic pipe is here to stay.

Discussion of this paper proved general interest to be considerable—many questions were raised and answered:

Rats and vermin may attack plastic pipe, but they will not eat it. This is not a serious problem.

Traffic vibrations have loosened plastic fittings at the corporation cock, but that has been replaced by brass fittings.

Frozen plastic lines have been successfully thawed by steam in New Hampshire installations.

An installation of plastic pipe at Fax, West Va., developed failures and burst because the water pressure (about 100 pounds) was high and an unsuitable pipe was used.

The Frank Harmsteds of Philadelphia (left) and others enjoy the sunshine while watching Scranton Gillette sink the winning shot in a putting contest.

Plastic pipe softens above 130°F and is not satisfactory for hot water uses.

Accelerated depreciation tests have indicated plastic pipe to have a life expectancy of 40 to 50 years.

In larger sizes of pipe, the coefficient of friction is roughly comparable to that of copper tubing.

The recommended pressure ("working pressure") for Carlon "EF" pipe was cited as: 162 lb. for ½-in. pipe, and 45 lb. for 6-in. pipe.

Plastic Pipe in Use

"EXPERIENCE WITH PLASTIC SERVICE PIPE" was described in a paper by Allen M. Symonds, General Engineering & Construction Co., Boston, Mass., who noted that 687 lead service lines are still in use in the Boston system.

The American Water Works Service Co. was first, in 1951, to begin the use of plastic service pipes; of their 2,150 installations, 149 are in New England. All these are Carlon "EF," originally with plastic couplings which proved easy to break. The plastic couplings have been replaced with bronze adaptors; stainless steel clamps having readily stripped screw threads have been improved and the present design appears satisfactory. Experience shows plastic pipe to be very brittle at 20°F or lower temperatures.

Summarizing reports by Martin Flentje (A.W.W. Service Co.) and by New England water works managers, Mr. Symonds cited these advantages: no failures of plastic pipe or of bronze adaptors are reported; the pipe is a non-conductor of electricity; and it is chemically inert. There has been trouble reported with metal clamps, the pipe requires careful laying, and it is recognized that there is only a limited period of use for real evaluation of its characteristics.

Where pressure pulsations exist, lead pipe becomes "tired"—and plastic pipe stands up better. It seems desirable to test the merits of plastic pipe under local conditions by making an experimental installation for study.

Discussion of this paper developed further questions-and-answers:

Standard corporation cocks are used, requiring only the special adaptor.

Plastic pipe will stand vacuum of up to 1½-in. without collapse.

The conventional polyethylene plastic appears to present no taste and odor or toxicity problems.

Plastic pipe will stand up to "pulling through" installations.

Regarding its flexibility on freezing; the expansion characteristics of the pipe are satisfactory within its yield strength, but fittings may not be acceptable under the same conditions.

Programmers

Malcolm Pirnie
Consulting Engr.
Malcolm Pirnie Engrs.
New York, N. Y.

F. Wellington Gilcreas
Lab. & Research Div.
State Health Dept.
Albany, N. Y.

Regarding service fittings: Mueller inserts and Dresser couplings have been in service for more than one year without failures; these provide metal on both sides, and curb cocks are easier to operate.

Threaded fittings are not available for plastic pipe: the material has too low a tensile strength to make these satisfactory.

Flared type fillings are used successfully in plastic tubing sizes of ⅛-in. to 1-inch diameter.

The New Lawrence Station*

"REORGANIZATION OF THE LAWRENCE, MASSACHUSETTS EXPERIMENTATION STATION," was the title of a paper by C. I. Sterling, Jr., Chief Engineer, State Department of Health, Boston, Mass.

*These sessions were reported by V. W. Langworthy, Research Chemist, The Chlorine Institute, Inc., New York.

Established in 1886 to facilitate cooperative water and wastes studies, the engineering experiment station grew out of an hydraulics laboratory located earlier at Essex, Massachusetts. Important personalities in the sanitary field were connected with the station as they pursued their scientific specialties. Among those individuals who served at the station were Thomas Drown, chemical analysis; Dr. W. T. Sedgwick, water biology; Allan Hazen, filter materials; Edwin O. Jordan, bacteriological methods; George W. Fuller, engineer; and Harry W. Clarke, whose complete professional cover was devoted to the station.

A significant contribution was made in 1893 when the sand filters were first investigated in an attempt to reduce the death rate due to typhoid fever. Mr. Sterling related numerous examples of contribution originating at the station, pointing out that facilities were crude and outmoded, until funds were provided in 1951 for a new building. Now nearing completion, the modern structure is located in Lawrence, on a new 2.5 acre site. The three story, brick-faced building includes the bacteriology laboratories for the state health department, radioactivity laboratory, air pollution laboratory and a plumbing laboratory where apprentice plumbers can be trained. Outside areas are available for pilot scale investigations of water and waste treatment problems.

A significant change in operation is planned for the station, since it will operate seven days per week enabling an uninterrupted sampling schedule to be maintained by the field staff. Research is to be carried out on a project basis to permit direct investigation of a problem. Review committees will select projects and analyze progress.

Important fields of endeavor listed by Mr. Sterling are to assist in industrial development, and to attempt to find reasonable standards as regards swimming and shellfish waters. The new station, when completed, will have cost approximately $500,000.

Endless Search for Water

"NEW YORK'S QUEST FOR INTERSTATE WATER," by K. R. Kennison, Chief Engineer, Board of Water Supply, New York City, a paper in which the author reviewed the development of the Croton reservoir system and its later expansion to include the Catskill supply.

Development of the upper reaches of the Delaware River, beginning in 1929, has progressed under the eyes of the United States Supreme Court. New York City has proceeded

PICNIC in the Poland Spring pine grove
Buffet luncheon served outdoors with a musical background.

through stages of water supply development which include both the East and West Branches of the Delaware River.

Slides illustrated geographic locations of the impounding reservoirs, together with construction techniques used in dams, spillways and aqueducts. Also illustrated were the new 100 mgd emergency Hudson River pumping station, and charts depicting the city's water needs.

A hearing, scheduled October 15, 1953, before the U.S. Supreme Court, will culminate a unique course of action, where pre-court conferences between interested states (New York, New Jersey and Pennsylvania) counsels, and engineers have narrowed the issues involved. Purpose of the hearing is to boost New York City's use of Delaware water from 440 mgd (1931 ruling) to 800 mgd and to consider New York's plea for a new method of determining stream flow.

The Hudson River as a fresh water source receives continuing attention from the City's engineers, but has been accepted only as an emergency source of water by the mayor's advisory board.

Automatic Fluoridation Record

"An Investigation of Continuous Recording of Fluoride Concentration in Water," was the title of a progress report by K. F. Knowlton, Supt.-Chemist, Salem-Beverly Water Supply Board, Beverly, Mass. This equipment, provided by the Foxboro Company, is based on the principle of differing conductivity measurements made before and after the addition of fluorides to a treated water.

Slides illustrated construction of the carbon measuring cells, points of installation at the Salem treatment plant, and recording apparatus used. Studies were performed on filter effluent and, while chlorine caused no interference, inadequate lime mixing contributed inaccuracies until the lime was applied at a point preceding the filters.

As installed at Salem, the equipment was found to reflect changes in fluoride feed and to detect periods of faulty feeder operation. Sodium silico fluoride was the chemical used throughout the study.

J. G. Dobson, Foxboro Company, presented a prepared discussion of the Salem studies. He emphasized that Mr. Knowlton's summary represented a progress report on the development of this equipment. It was pointed out that the device does not measure absolute fluoride values; it does indicate the changes in conductivity resulting from fluoride addition to water.

Important points to be considered were briefly outlined by Mr. Dobson as he indicated the difficulties involved in automatic fluoride recording. Temperature, adequate mixing of readily soluble chemicals, instrument calibration, pH value (pH 5.0 or less will cause interference), and problems due to mineral interference, are all involved in the reliable operation of this type of equipment.

Destroying Bacteria and Viruses

"The Significance of the Coliform Test in Relation to Intestinal Virus Pollution of Water," was the title of a paper presented by F. W. Gilcreas, Division of Laboratory and Research, New York State Department of Health, Albany, N.Y.

In reviewing fundamental data, the history of the coliform index test was noted beginning with the work of Dr. Theobald Smith in 1893. Improvements have been made in bacteriological media, but the test does not indicate *all* significant pollutants which may be present in a water sample. It was emphasized that the significance of viruses has not been thoroughly explained with regard to potable water.

Mr. Gilcreas and his associates performed comparative studies to determine the effect of storage, chlorine, heat, ultra-violet irradiation, filtration and sedimentation on viruses and bacteria. Laboratory strains of *B. coli* and mouse-adapted strains of Coxsackie and Theiler viruses were the test organisms used to inoculate the various types of water being studied.

Results of the study indicate that relative survivals of viruses and coliform bacteria are the same at normal temperatures and seasonal variations. Mr. Gilcreas concluded that existing standards are satisfactory for drinking water and bathing areas. Reduction of coliform organisms through chlorination will probably accomplish a parallel destruction of viruses.

Problems of Water Pollution

"Domestic and Industrial Water Supplies Face Pollution Problems," a paper by Malcolm Pirnie, Consulting Engr., New York, N.Y.

Present-day problems, including radioactive waste, sewage plant foaming, recreational water supply pollution, accidental chemical discharges into potable supplies, poliomyelitis viruses surviving sewage treatment processes, and gastrointestinal outbreaks were listed to emphasize that solutions to all problems are not known. Vigilance is required on the part of all waterworks personnel, to combat possible emergencies.

Cooperation between municipal and industrial personnel often can resolve a difficult problem. Mr. Pirnie reported the case involving pollution of water supply of Richmond, Va., by an industrial waste discharged upstream. Cooperative effort resulted in a waste product becoming a profitable material.

The possibility of water supply contamination resulting from insecticides or weed killers should be considered and intensively studied. Watersheds should be protected and constantly guarded.

The technical program ended with the presentation of a color film entitled "The Mascoma Speaks." The story told by the Mascoma River emphasized the need for pollution abatement when the recovery capacity of a stream is exceeded due to municipal and industrial contamination. A highly effective presentation, the film was produced by the staff of the New Hampshire Water Pollution Commission at a cost of only $500. It is used for its educational value at public hearings and on any occasion when pollution abatement is being discussed.

System Head Curves - Their Calculation and Use

By Superimposing the System Curve on the Pump Performance Curve Much Comes to Light

by MELVIN MANN, *Chief Proposal Engineer, Peerless Pump Division,* Los Angeles, Calif.*

A SYSTEM HEAD CURVE is a graphical representation of the relationship between flow and hydraulic losses in a given pipe layout. Since hydraulic losses are a function of rate of flow, size and length of pipe, size, number and type of fittings, each layout has its own characteristic curve and specific values. In virtually all pump applications, at least one point on the system curve is given to the pump manufacturer in order to properly select the pump. In many applications, however, it is desirable to graphically superimpose the entire system curve over the pump performance curve. The intersection of the pump head-capacity curve (H-Q curve) with the System Head Curve defines the operating point of the pump. It is the purpose of this article to review, by typical examples, the method of calculating system heads for the most common layouts and discuss some of the factors which are brought to light by superimposing the system curve over the pump performance curves.

Hydraulic losses in pipe systems are composed of the following:

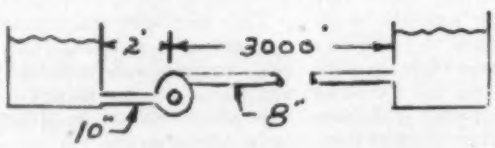
A — Pipe friction losses
B — Fitting losses (valves, elbows, etc.)
C — Entrance and exit losses (these normally occur at the beginning and end of a pipe line, respectively).
D — Losses due to change in pipe size by sudden or gradual, enlargement or reduction in diameter.

In the application of low head high capacity pumps, such as mixed flow or axial flow pumps, it is imperative that, when applicable, each of the above losses be accurately accounted for, because these losses usually represent a significant percent of the total system head. However, in applications involving relatively high static lift and/or relatively high pipe friction losses (long pipelines) it is usually unnecessary to account for losses listed under B, C & D, since these losses represent an insignificant percent of the total head. With the exception of examples I & II, all others which follow will take into account only the losses resulting from pipe friction. However, in actual practice each application should be checked to see what is the order of magnitude of each of the various hydraulic losses. A decision can then be made as to what losses should be accounted for.

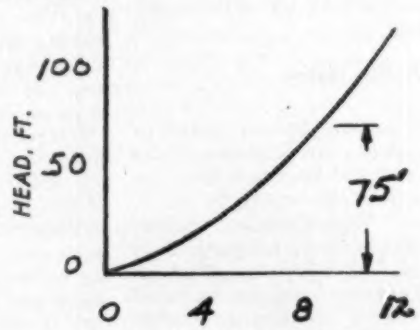
*Food Machinery & Chemical Corp., Los Angeles and Indianapolis.

DRAWING THE SYSTEM HEAD CURVE

I—No Lift; All Friction Head



NO LIFT—ALL FRICTION HEAD



100 GPM

(a) Typical Calculation

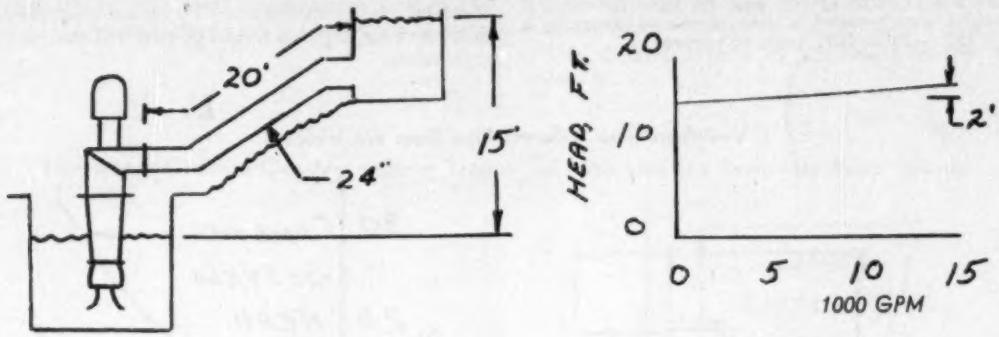
Assume detailed piping layout and losses as follows:
(Water Flow 900 GPM)

Entrance loss (tank into 10" pipe) is ½ $\frac{V^2}{2g}$	=	.10 ft.
Friction loss in 2' of 10" suction pipe	=	.02
Loss in 10" 90° elbow connected to pump (equiv. to 25' of 10" pipe)	=	.2
Friction loss in 3000' of 8" discharge pipe	=	74.5
Loss in 8" gate valve fully open (equiv. to 5' of 8" pipe)	=	.12
Exit loss from 8" pipe into tank A = $\frac{V^2}{2g}$	=	0.52
	L =	75.46

The system head curve starts at zero capacity and zero head. L equals the total losses at a given capacity. Since pipe losses vary as the square of capacity, this system curve is parabolic in shape and is a "steep" system curve.

In a similar manner all losses at other capacities should be computed and plotted against capacity. Note that if all losses were ignored except the friction loss thru the 3000 feet of discharge pipe, that the total system head would not change significantly.

II—Head Almost Entirely Static Lift; Little Friction



(b) Typical Calculation

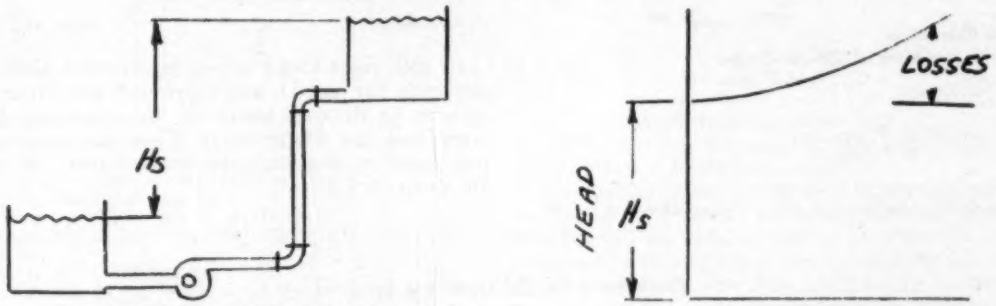
Assume detailed piping layout and losses as follows:
(Water Flow 15,000 GPM)

Friction loss in 20' of 24" pipe	= 0.4 ft.
Exit loss from 24" pipe in tank A = $\frac{V^2}{2g}$	= 1.6
L	= 2.0

The system head curve starts at the static lift head (H_s) and zero capacity. As in example (I), L represents the losses at capacity Q. However, unlike example (I), the pipe losses by assumption, are relatively small compared to H_s thus resulting in a "flat" system curve.

The purpose of this example is to basically indicate that almost 90% of the total head of 17 feet at 15000 GPM is composed of static lift resulting in a relatively flat system curve. However, it should also be noted that neglecting the friction and exit losses would result in an appreciable error.

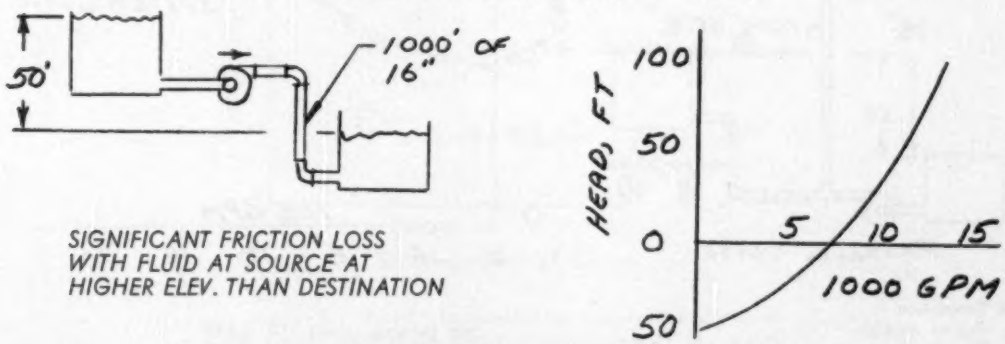
III—Significant Friction Loss and Lift



SIGNIFICANT FRICTION LOSS AND LIFT

In this case the value of the system head at any capacity is the sum of the piping losses at that capacity plus the static lift H_s. The system head curve increases rapidly with capacity because the losses in the pipe system increase as the square of the capacity. This system curve is basically identical to case I, except for the addition of a static lift, H_s.

IV—Significant Friction Loss with Fluid at Higher Elevation at Source Than at Destination



SIGNIFICANT FRICTION LOSS WITH FLUID AT SOURCE AT HIGHER ELEV. THAN DESTINATION

(c) Typical Calculation

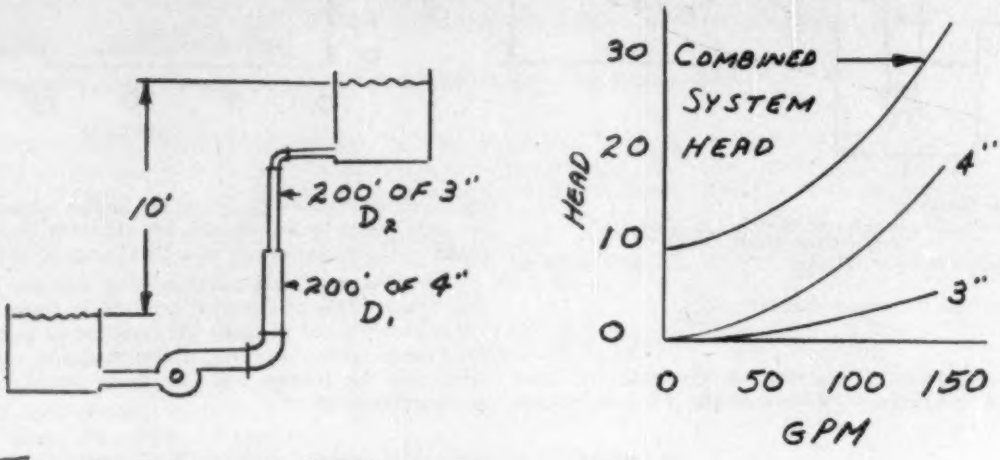
Assume 1000 feet of 16" discharge pipe and H_s = 50'
Say 5000 GPM, Q_1
Friction loss in 1000' of 16" pipe = 25'

Say 7200 GPM, Q_2
Friction loss is 1000' of 16" pipe = 50'; this is maximum flow which could occur by gravity flow.

Say 13000 GPM, Q_3
Friction loss in 1000′ of 16″ pipe = 150′; therefore, if 13000 GPM were required, a pump capable of generating a head of 150′ — 50′ = 100′, would be required.

In this installation capacities up to 7200 GPM will occur by gravity flow alone. To obtain capacities beyond this, however, a pump would be required to overcome the pipe losses.

V—Where Two Different Pipe Sizes are Involved



TWO DIFFERENT PIPE SIZES

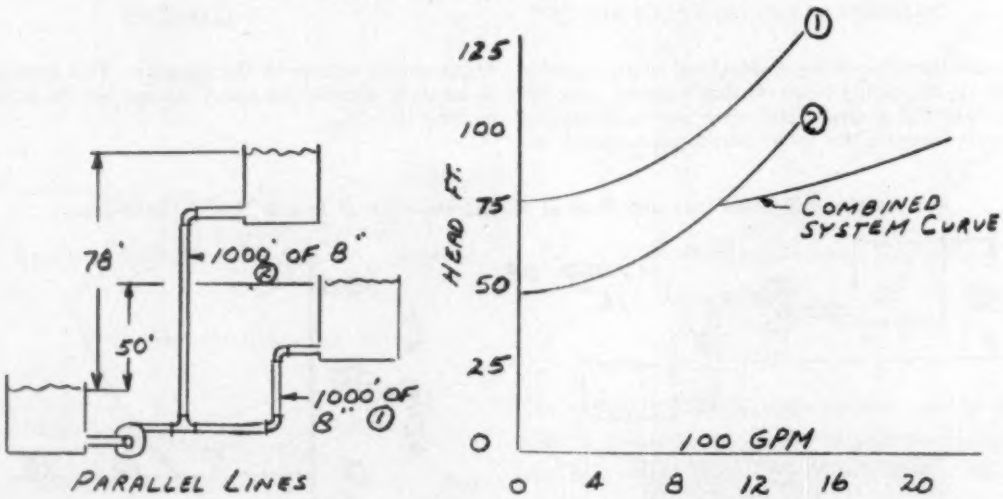
(d) Typical Calculation

Assume D_1 composed of 200′ of 4″ pipe
D_2 " " " of 3″ pipe
At say, 150 GPM:

Friction loss L_1 in 4″ pipe = 5′
" " L_2 in 3″ pipe = 19′
$L_1 + L_2$ = 24′
If H_s were 10′, total head at 150 GPM = 10 + 24 = 34′

In such cases losses versus capacity are plotted independently for pipe D_1 and D_2 respectively. At any given capacity Q, the total losses for the system are the combined loss for D_1 and D_2. Thus the combined system curve at a given capacity represents the sum of $H_s + L_1 + L_2$.

VI—Where Parallel Lines are Involved



PARALLEL LINES

(e) Typical Calculation

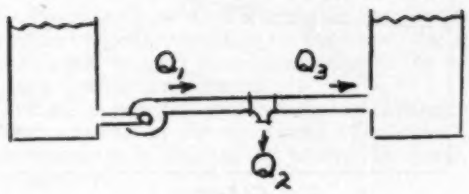
Assume H_{s1} = 50 feet
H_{s2} = 78 feet
Line 1 composed of 1000′ of 8″ pipe
Line 2 composed of 1000′ of 8″ pipe
Say capacity equals 550 GPM
Friction loss line 1 = 10 feet
" " " 2 = 10 feet

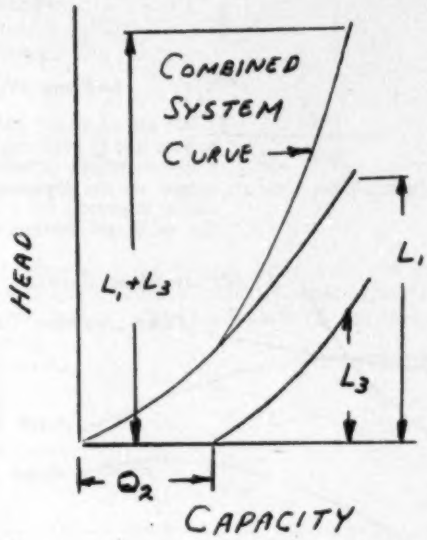
Say capacity equals 1150 GPM
Friction loss line 1 = 38 feet
" " line 2 = 38 feet
Total head (lift plus friction)
Line 1 at 1150 GPM Q_1 = 50 + 38 = 88 feet
Line 2 at 550 GPM Q_2 = 78 + 10 = 88 feet

System curves are plotted independently for lines 1 and 2, respectively. The total system curve is then obtained by adding capacities of curves 1 and 2 at the same head.

Therefore, a typical point on the total or combined system curve at 88 feet is $Q_1 + Q_2$ or 550 + 1150 = 1700 GPM. Thus, to produce 1700 GPM thru this system, a pump capable of generating 88 feet would be required.

VII—Where Constant Quantity is Being Tapped Off Main Line and Remainder Flows Through





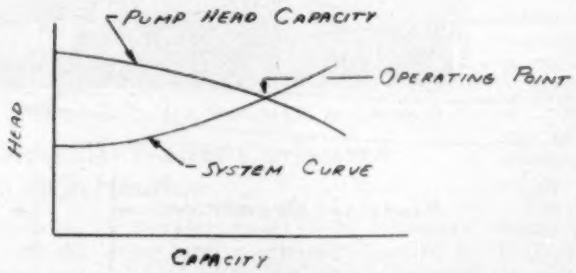
(f) Typical Calculation

Assume flow taken off at Q_2 is 300 GPM
Assume line 1 is composed of 500′ of 10″ pipe
Assume line 3 is composed of 50′ of 6″ pipe
Say flow is 1500 GPM thru line 1
Friction loss L_1 for line 1 = 11 feet
Friction loss L_3 for (1500—300) 1200 GPM thru line 3 = 8 feet
Say Flow is 1800 GPM thru line 1
Friction loss L_1 for line 1 = 15 feet
Friction loss for L_3 (1800—300) 1500 GPM thru line 3 = 12 ft.
Combined system curve at *1500 GPM* = $L_1 + L_3$ = 11 + 12 = 23 ft.

In this case a constant given quantity Q_2 is being tapped off main line 1 and the remainder flows on thru line 3. The procedure is as follows:

Loss versus capacity is plotted in the regular manner for line 1. The system curve for line 3 is displaced at zero head by an amount equal to Q_2 since Q_2 represents the quantity passing thru lines 1 and 2 but not thru line 3. The curve for line 3 is plotted then in the regular manner but the curve is graphically displaced so as to show zero head at capacity Q_2. The combined system curve is then obtained by adding at a given capacity, head losses from line 1 plus line 3 (see calculation).

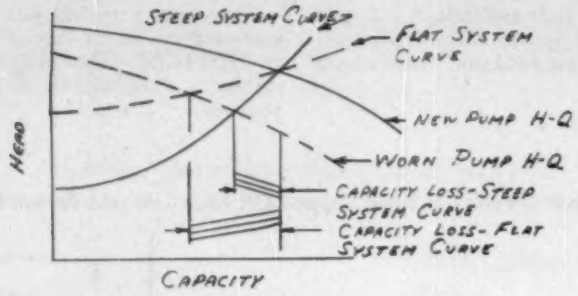
USE OF SYSTEM HEAD CURVE



Superimposition of Curves

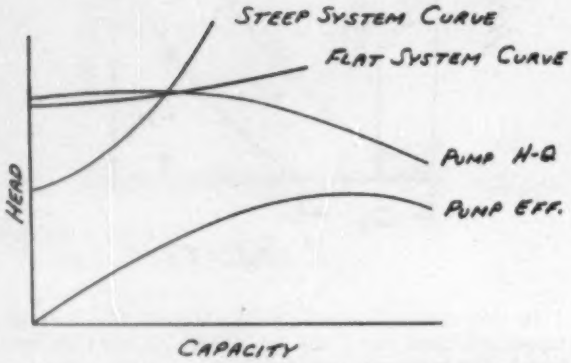
As earlier stated, superimposing the system curve on the pump performance curve, shows where the pump will operate.

In addition to this, the shape or slope of both the system curve and pump curve are significant in certain applications as will now be shown.



I—Pump Wear vs. Loss of Capacity

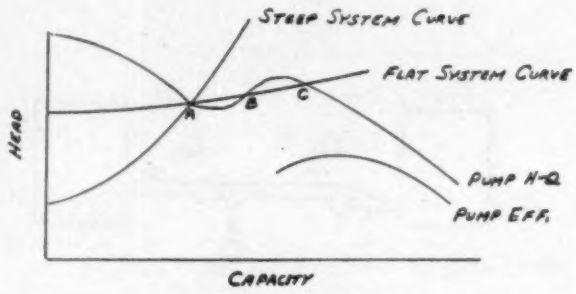
We are all aware that when a pump wears there is certain to be a loss in performance. The amount of capacity loss for a given amount of wear, however, will depend, to a large extent, on the characteristics of the system and, as shown above, is greater for a given amount of wear if the curve is flat vs. a steep system curve.



II—Selection of Low Specific Speed Pumps Near Shut-Off

A characteristic of low specific speed units is a relatively flat head capacity curve at capacities near shut-off. Occasionally it is necessary to pick such a unit near shut-off because of a high head, low capacity requirement. Ordinarily pumps are physically capable of operating continuously near shut-off. If this is the case the system curve should be examined before applying the pump.

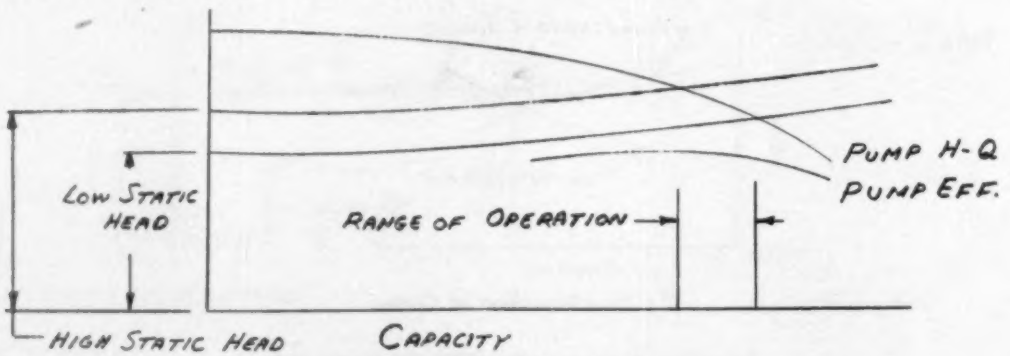
It is evident from the curves that a shallow or flat system curve in conjunction with a flat pump curve can lead to performance trouble if the pump is slightly off in head capacity or if the system curve is calculated slightly too low. On the other hand, with a steep system curve no hydraulic performance trouble would be anticipated.



III—Selection of High Specific Speed Pumps Near the "Dip"

A characteristic of some high specific speed units is that the head capacity (H-Q) curve dips at capacities to the left of peak efficiency. Occasionally it is required to operate pumps at or near the dip and the question arises, "Would the performance be satisfactory?" Again let us look at the system curve to help find an answer.

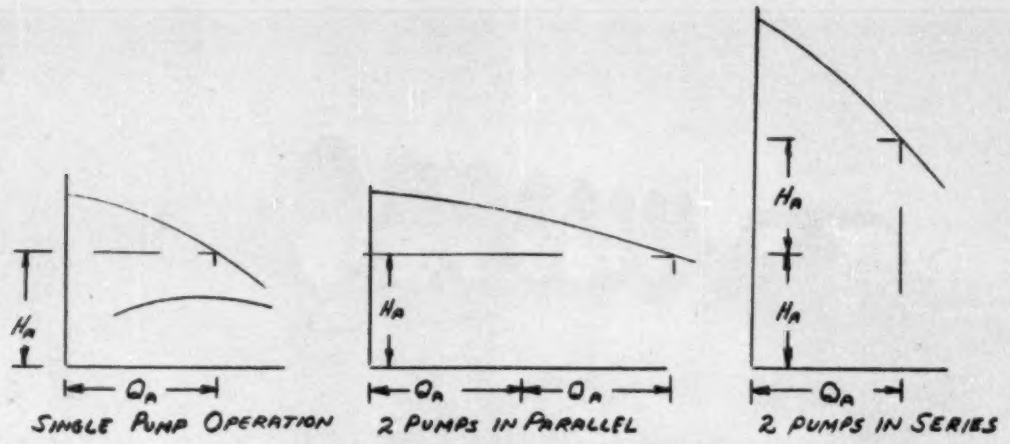
If point A is the desired performance, say for some transient high head condition, it can be seen that with a steep system curve no trouble should be encountered whereas a shallow system curve intersects the pump curve at 3 points (A, B & C) which might result in unsatisfactory operation.



IV—Variations in System Head

System demand can vary because of variations in suction or discharge surface levels or increased pipe friction due to increased pipe surface roughness.

The above curves indicate that for the pump selected and for the range of static heads anticipated that operation in a favorable range of efficiency should be expected. These curves also graphically indicate the magnitude of drop in capacity when the high head condition occurs.

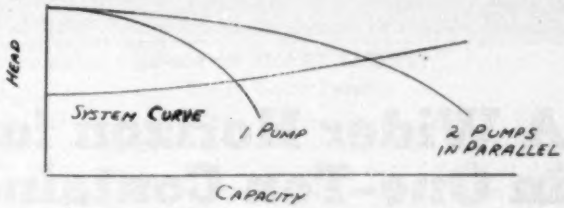


V—Parallel Or Series Operation of Pumps

Frequently where there is a wide demand in capacity requirements it is common to operate two or more pumps in parallel or series to satisfy the high capacity requirement and to operate just one of the pumps for the low demand. To properly select and evaluate the pump selections under various conditions of operation, the system curve should be used in conjunction with the composite pump performance curves.

For pumps in *parallel*, performance is obtained by adding the *capacities* at the same head. For pumps in *series*, performance is obtained by adding the *heads* at the same capacity.

Superimposing the system curve over the pump performance curves clearly indicates what capacities can be expected and at what head each of the units will be operating.



CONFERENCE PLANNERS—L. L. Hedgepeth, Dr. A. P. Black, and H. M. Conway, Jr.

1954 Southern Industrial Wastes Conference to be in Houston

Representatives of the Manufacturing Chemists Association and the Southern Association of Science and Industry, Inc., have met at Atlanta, Ga., to complete arrangements for the 1954 Southern Industrial Wastes Conference. The conference will be held in cooperation with the Texas Chemical Council at the Hotel Shamrock, Houston, Texas, April 21 to 23, 1954.

Planning details of the conference, above, are: conference chairman L. L. Hedgepeth, American Cyanamid Co., head of the MCA stream pollution abatement committee; Dr. A. P. Black, Univ. of Florida, SASI president; and H. McKinley Conway, Jr., SASI director. Mr. Hedgepeth is editorial associate of *Water and Sewage Works*.

The chairman announced that the program will cover both air and stream pollution problems, including managerial as well as technical aspects. The Houston conference will be the largest assemblage ever held in this country of experts in the field of pollution inquiry and control, representing academic research, industry, government, state and civic agencies.

Washington State College Corrosion Short Course

A five-day course at Washington State College, February 1-5, 1954, will present an intensive review of the fundamental aspects of corrosion and discussions of corrosion control applications in industry. This short course is sponsored by the National Assn. of Corrosion Engineers and the Division of Industrial Services of the Washington State Institute of Technology.

The program and additional information may be obtained from: Prof. E. B. Parker, Director, Div. of Industrial Services, State College of Washington, Pullman, Washington.

SPECIAL FRAME for trucking 8 one-ton containers. Units having 6 and 10 cradles are also used.

A Wider Horizon for Chlorine in One-Ton Containers

Moving Chlorine from Producer to User in Small Multi Unit Tank Cars Which Ride on Rubber

by **J. H. WILHARM**, *Director of Traffic, Diamond Alkali Co. Cleveland, Ohio*

THE safe handling of chlorine in ton containers by motor truck is a problem which became evident some years ago because of certain conditions which existed at municipal water treatment and sewage disposal plants.

The ton container, when first designed and authorized for transportation of chlorine by the Interstate Commerce Commission, was built to I.C.C. Specification 27. Fifteen of these containers carried on a specially built railroad car underframe constituted what was known as a multi unit tank car.

When the containers were filled with chlorine, the railroads transported the car as a tank car, assessing freight on the net weight of the containers, which was 30,000 pounds. Likewise, the empty car with a full or partial complement of containers was returned to the original shipping point by the railroads as an empty tank car under the mileage equalization tariff. In later I.C.C. regulations the specification was changed to ICC 106A500, and the car and its complement of 15 removable tanks becoming a Class 106A500 tank car.

Transporting from Rail Siding to User's Plant

The first problem which confronted both the chlorine supplier and some municipalities was the transportation of these ton containers to plants which were located somewhat removed from the city proper and, in many cases, not served by railroad facilities. This required the shipment of the ton containers by multi unit tank car to the nearest rail location where facilities were available to remove the containers from the car to trucks for transportation to the plant.

This procedure not only was expensive, but certain hazards were encountered in the transfer of the containers from the car to the truck, and the transportation of the containers in or on ordinary truck bodies was cumbersome and dangerous. At times, the containers were merely loaded loosely in the truck body and rolled more or less freely while in transit. Sometimes inadequate wooden chocks were used to hold the containers in place, but even these chocks frequently became dislodged and the containers were free to move as a result.

In view of these conditions, Diamond Alkali Co. conceived the idea of transporting the filled ton containers and the returned empties on a specially built truck body that would hold the containers in place and constitute a much safer medium of transportation than that previously described. Such transportation is authorized in the Bureau of Explosives tariff, the only requirement being that the containers shall be securely chocked or clamped to the truck or semi-trailer to prevent shifting.

Special Truck Body for Safe Handling

Diamond first designed a series of six cradles mounted on a substantial frame constructed of steel channels or I-beams. The contour of the cradles was designed to exactly fit the circumference of the ton containers so that they could not possibly move backward or forward. Substantial clamps were attached to the base of the unit at both ends of each container to prevent the containers from slip-

ping sideways. This unit was so designed that it could be securely attached to almost any kind of a flat top truck trailer by a series of U-bolts which were inserted under the two main fore and aft beams of the trailer body.

What we designed is practically a small multi unit tank car riding on rubber on the highway rather than on steel wheels on the rails. A picture of the unit and detail drawings are here shown.

We have safety factors which attend this specialized truck movement which are not and cannot be present in connection with a multi unit tank car movement.

Emergency Kit Provided

On each of our trucking units, we include a Solvay Safety Kit in a substantial case which, in addition, is enclosed in another weather proof box. This kit contains valve and fusible plug wrenches, and other devices which may readily be used to close off any leak which might possibly occur in transit. One of the emergency devices is so constructed that it can be quickly inserted on the valve end of the container to close off an entire valve if a leak should be discovered, either in the valve itself or at the threading where the valve is inserted in the cylinder head. Both valves can be so closed off if such an emergency arises. Another device will similarly close off an entire fusible plug should a leak in one of these develop in transit.

To avoid the possibility of wrenches and other parts of the kit being used for truck repairs, the outer box is closed with a seal. When each unit returns to the plant, the box is checked before the next load goes out, and if the seal is broken, the contents of the kit are carefully checked and any missing parts are replaced. As a regular procedure, whether the kit has been used or not, once each month the contents are checked and each device carefully examined to make sure that the gaskets and other perishable items are in proper condition for use in an emergency.

Other Safety Provisions

A gas mask of approved design for chlorine also is carried in the cab of each of the tractor units which haul these special bodies.

Competent and reliable drivers are selected for these units and are given a full course of instruction with respect to the use of the safety kits.

The truck units are adequately placarded to indicate that their cargo is chlorine, and all regulations of the Bureau of Explosives and I.C.C. governing the transportation of dangerous commodities by motor truck are complied with.

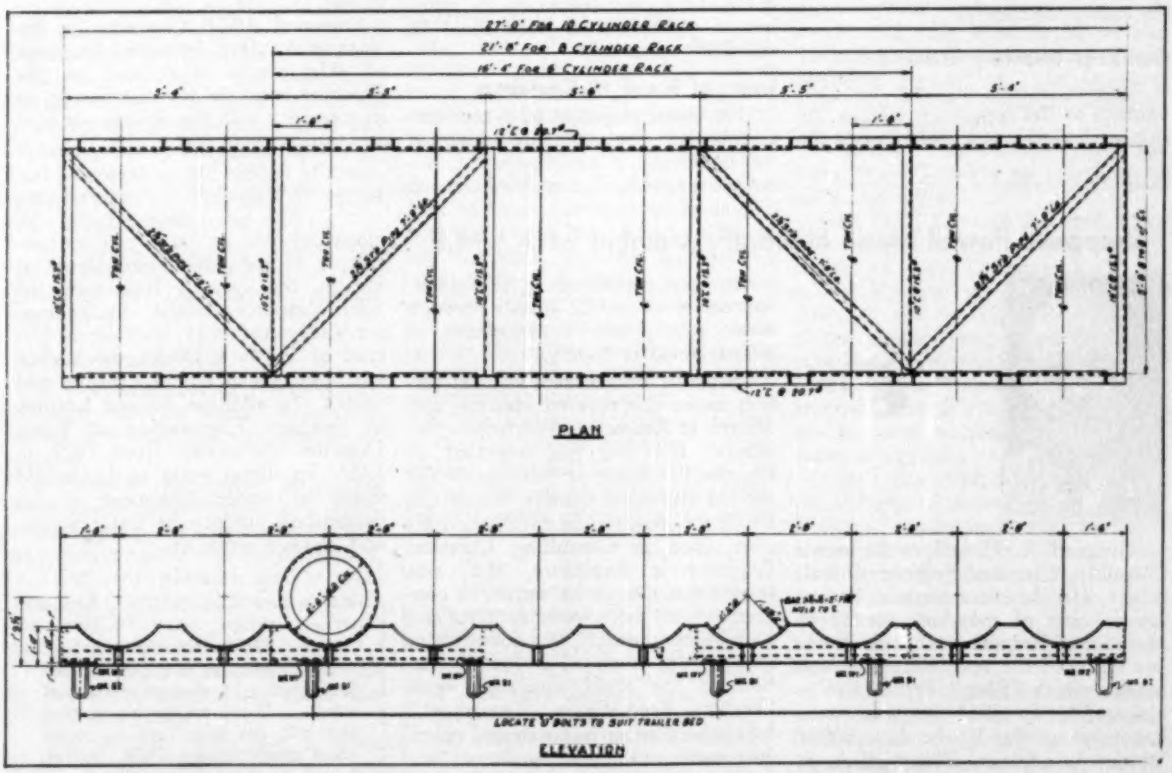
The usual public liability insurance coverage for personal injury and property damage is carried for each of the units. In addition, commodity coverage is carried to cover any injury or damage which might be the result of the escape of gas.

Direct Shipment Possible

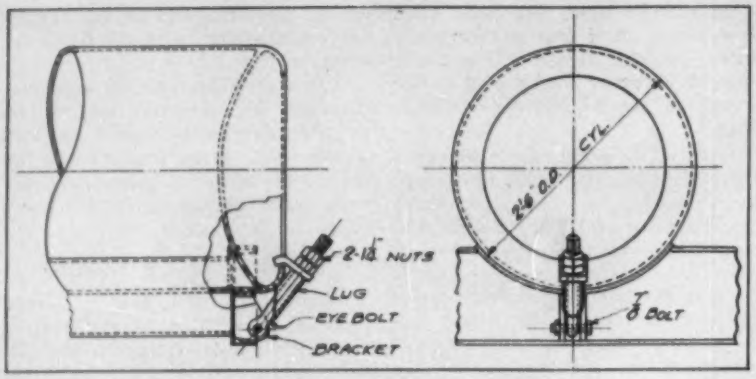
With such a safe and substantial unit as this available, it was obvious that the hazards which attended the transfer of chlorine containers from car to ordinary truck could be eliminated by moving the ton containers directly from the chlorine producing plant to the water treatment or sewage disposal plant *without* any intermediate handling whatever. (In the case of one municipality, the former rail-truck movement involved the movement of containers by car for about 60 per cent of the distance and by truck for the remainder.)

Lower Costs Possible

In addition to the elimination of the hazards, economies were effected in certain instances, since the cost of the through truck movement from producing point to ultimate consuming station could be accomplished at a rate less than the aggregate of the



DIMENSION drawings—plan and elevation—of ton container cradles and frame for mounting on trailers



END CLAMP for ton containers to prevent slip

rate for the rail transportation for part of the distance, plus transfer and the truck movement beyond the transfer point.

To set up the rate for the truck movement, we took the return of the empty containers into account as in the case of the rail movement, and made the rate for the trucker based upon the net weight of the ton containers, outbound only, adequate to cover the service performed by him for the entire round trip. This saved all the accounting and bookkeeping that would have attended the distribution of the charges for a given shipment, if gross weights, outbound, were charged for and if an additional charge was made for the return of the empty containers.

Container Inventory Reduced

Another safety measure and advantage to the consumer, effected by this method of transportation, was the substantial reduction in inventory of filled containers which had to be carried at a consuming point to permit uninterrupted chlorination.

When the multi unit tank car was used for either all or part of the trip, the second car generally arrived at the consuming plant before all of the 15 ton containers received on the first car had been emptied. Consequently, the second car came back to its home point with less than its full complement of 15 containers, many times as few as 2 or 3. The net result was an accumulation of containers at the consumer's plant far in excess of that necessary to carry on the chlorination at that plant. With our trucking unit carrying 6 containers, and more frequent and speedy deliveries, the number of containers on hand could be cut down materially.

Loads of 8 and 10 Containers

Our initial shipment of 6 ton containers on the specially designed trucking unit was made on July 19, 1938. Since that time, additional units suitable for 8 and 10 ton containers were built for use on movements where deliveries of containers in these numbers could be made in keeping with the rate of consumption and the ability of the consumer to return empty containers rapidly enough to permit maintaining only a small inventory of filled containers.

Conclusion

We feel that a service to the water and sewage works industry has been rendered that not only is economical, but is the ultimate in safety. This method of transportation is very adaptable to the water and sewage works industry, and is also of considerable benefit to many commercial consumers of chlorine, such as a steel mill, for example.

In a large mill, there may be two or more chlorination units located some distance apart. These trucking units lend themselves to the distribution of filled cylinders directly to chlorination stations and to the pickup of empties at the same time. Otherwise, such a mill would have to take carload deliveries and provide their own distribution around the plant with the further obligation of returning the empties to the siding where the car is placed. Here again, much less handling and rehandling is involved.

Diamond Alkali Company, in the interest of safety, furnished drawings of this special equipment to the Chlorine Institute for distribution to its members with the right to use it at any time without cost.

Sheppard Powell Made Honorary Member of A.S.M.E.

Sheppard T. Powell, well known Consulting Chemical Engineer of Baltimore, Md., has been made an honorary member of the Am. Society of Mechanical Engineers. It constitutes one more of the several awards and honors which "Shep" Powell has to his credit. In 1951 he was made honorary member by the Am. Water Works Association. This high A. S. M. E. recognition derived from "his meritorious contributions to the advancement of public health through water supply and developments in industrial water supply."

Sheppard Powell received his tuition under the revered chemist, Dr. Mason, at Rensselaer Polytechnic Institute. His first job was that of Chemist in Charge of Purification for the old Baltimore County Water Co. From this position he established his own office as Consulting Chemical Engineer in Baltimore, Md., and served many large industries in connection with their water supplies and soon became reputed as a boiler water expert. This resulted in his production of the highly-appraised book "Boiler Feed-Water Treatment," which became an international reference work.

In addition to his practice in the industrial field he has served as consultant to the Md. State Dept. of Health, the City of Baltimore, the Natl. Resources Board, the Tennessee Valley Authority, the Federal Bureau of Yards & Docks, the Reconstruction Finance Corporation and others. In addition he was lecturer in Sanitary Engineering at Johns Hopkins University from 1927 to 1937. In recent years he has added industrial waste treatment to his established practice in water supply and sewage treatment.

On Perfectionism

In a world that is imperfect, perfectionism is a dangerous state of mind . . . If you are doing your best, you will not have time to worry about shortcomings.—*Robt. Hillyer.*

WATER WORKS PRACTICES

Source of Supply
Location and Construction of Wells

The Eighth of a Series

by **GEORGE E. SYMONS, Ph.D., *Consultant & Technical Editor, Larchmont, N. Y.***

THE lecture on Source of Supply—Part 2, Ground Water, presented general information and data on the occurrence, quality, types of underground supplies, and selection of sources. This lecture will deal with the subject of wells, the most common type of underground water supply.

A . . . Types of Wells

Wells are classified broadly as shallow or deep wells, with different types within each category.

1. SHALLOW WELLS

a. Shallow wells are those which tap ground water aquifers in pervious material overlying an impervious stratum and are less than 50 ft deep.

b. Shallow wells are sometimes called *gravity wells,* since they do not pass through an impervious layer and therefore the water both inside of and surrounding the well is at atmospheric pressure. This type of well is also called a *water-table well.*

c. Shallow wells are usually classified according to method of construction, as: Dug, driven, caisson, and bored.

2. DEEP WELLS

a. Deep wells are driven or drilled through one or more impervious layers to a water bearing stratum, or aquifer.

b. Several descriptive terms are used in connection with deep wells, depending on various characteristics of construction or natural conditions.

--- The term *pressure well* or *artesian well* is applied to a well in which the level of water within the well rises above the level of the aquifer.

--- A *flowing well* is an artesian well in which the water rises above the ground and flows.

--- All flowing wells are artesian wells but all artesian wells are *not* flowing wells.

--- Deep wells may be classified according to method of construction, as: Driven, drilled, gravel-packed, or gravel-wall.

3. RANNEY WELLS

The Ranney Water Collector is, in reality, a combination of driven wells and a dug well of large diameter sunk to a water-bearing stratum, usually "shallow," but sometimes "deep," with cylindrical screens driven radially, into the aquifer or zone of saturation. This type of well has also been called a "water-mine."

B . . . Location of Wells

1. DIVINATION OR DOWSING

a. Water diviners or "dowsers" are persons who claim an ability to locate underground water by an occult, supernatural, or uncommon "power" not given to everyone.

b. Dowsing usually consists of the dowser holding a Y-shaped twig or fork of hazel (or some other wood) with the prongs held in the two hands and the stem pointing horizontally forward from the body.

--- The dowser traverses the ground and when the fork turns in his hands against his efforts to restrain it, the dowser claims he is treading above an underground water source.

c. The history of divining is lost in the folklore of antiquity but the earliest recorded description of its use to locate metals appeared in 1430. Martin Luther referred to the divining rod in 1518 and Agricola wrote about its use in his articles on mining in 1530 and 1556.

--- Dowsing for water was first mentioned in 1655. Since then the belief in the practice of dowsing for water has become more persistent while divination for metals has been replaced by more scientific approaches.

d. Controversy over the theory of dowsing and in fact over the very existence of the "power" have raged since its alleged earliest use.

--- In 1917, Ellis of the U. S. Geol. Survey in Water Supply Paper No. 416 presented strong scientific arguments against its validity.

--- In 1926, Sir William Barret and Theodore Besterman authored a long historical account of "The Divining Rod" and concluded that the power of the dowser does exist.

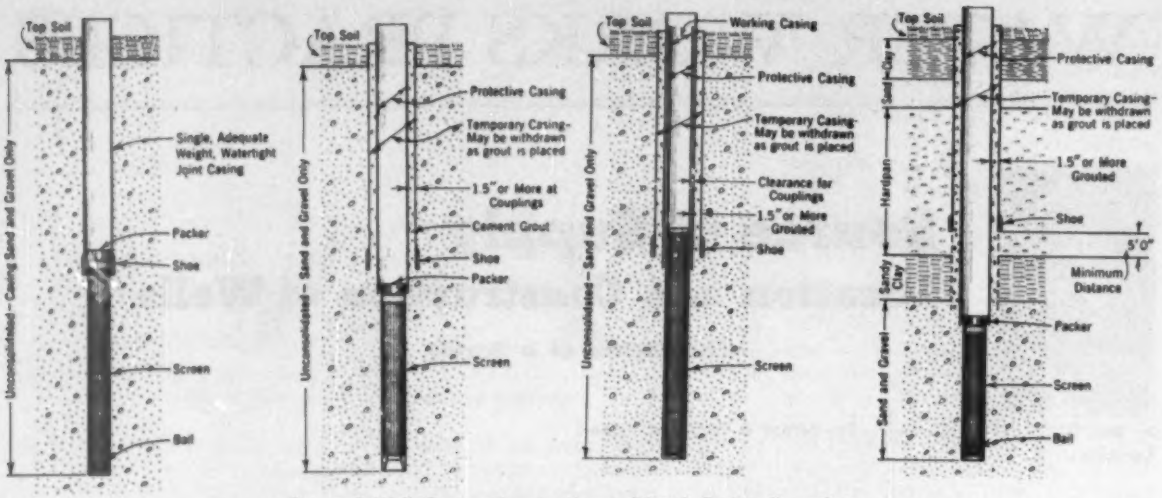
--- In 1948, Baker in his "Quest for Pure Water" makes no reference at all to the subject.

--- In 1951, Kenneth Roberts, a fiction writer, authored a book, "Henry Gross and his Dowsing Rod," in which Roberts offered "proof" of dowsing and in 1953 Roberts authored another book called the "Seventh Sense," in which he asserted his belief in the "power." Both books received adverse criticism by reviewers in technical publications in the water works field.

--- Best scientific demolishment of the validity of dowsing and of Mr. Robert's contentions was contained in two articles by Thos. M. Riddick, Consulting Engineer and Chemist; one in Harpers Magazine in July, 1951, and the other in the Journal of the American Philosophical Society in Oct., 1953.

--- Statistical data on dowsing versus scientific methods of ground water location were collected in Australia. More than half of the "dowsed" wells were dry holes while less than one-

This article is one of a series on the general subject of "Water Works Practices," developed by Dr. Symons in the simple style of a short course lecture and designed to be of interest to small plant operators, new operators, students and any others who may wish to review the fundamentals of the subject.—*The Editors*



Types of Well Construction in Unconsolidated Caving Formations.
(Reproduced from AWWA Specifications for Deep Wells)

Type I—Simple casing packer—sealed to strainer

Type II—Grout protected casing for pollution and corrosion prevention

Type III—Double casing to permit pulling of working casing and screen

Type IV—Wherein water is taken below hard-pan, shale or clay

fourth of wells located by scientific methods were dry.

- - - Few engineers will rely on dowsing as a means of locating underground aquifers.

2. Geological Approach

a. Shallow Wells

(1) Valleys of surface or buried rivers offer good locations for wells.

(2) High ground may contain water if there is still higher ground to serve as a catchment area.

(3) Porous ground materials at or above the level of a nearby surface stream, that flows through the material, are good sources of ground water - - The farther from the stream, the higher the elevation of the water.

b. Deep Wells

(1) Surface conditions seldom indicate the presence of artesian water.

(2) Exploratory test wells may be drilled and pumped to determine the direction of underground flow and limits of the aquifier.

3. Geophysical Prospecting

a. In the seismic method, sound or stress waves are propagated at or below the ground surface by means of an explosion, usually of dynamite.

- - - These waves spread through the earth with the speed of travel varying directly as the density of the strata encountered.

- - - Some waves are reflected by the different strata and return to the surface, where sensitive instruments make a record from which profiles of underground strata can be drawn. These profiles may be useful in indicating the location of water bearing strata.

b. The resistivity method depends on the resistance of underground strata to the flow of an electric current through them. Water in the ground has less resistance than non-water-bearing strata.

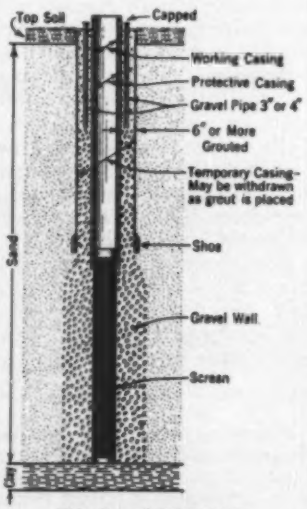
4. Sanitary Considerations

a. Wells should not be located where water quality will be subject to pollution by surface drainage or from underground waste disposal wells.

b. Shallow wells, especially dug wells, should be located at safe distances from sources of pollution and above such pollution sources.

- - - Outhouses should be at least 250 ft. from a well, but no fixed distance can assure that the water will be safe. Local conditions constitute an important consideration.

- - - See section on "Protection of Wells" later in this lecture.



The Gravel Wall Well
(AWWA Specifications)

Type V—Is type III construction with the gravel-pack feature added. Note the double casing and protective grouting down to the gravel

5. Spacing of Wells

a. Grouping of wells in a well field is dependent on the type of aquifer, amount of water, area of land available, rate of pumpage, and other factors.

b. Interference is the overlapping of area subject to the well's effect. Interference between wells should be at a minimum, but to obtain the maximum yield from the well field some interference is necessary.

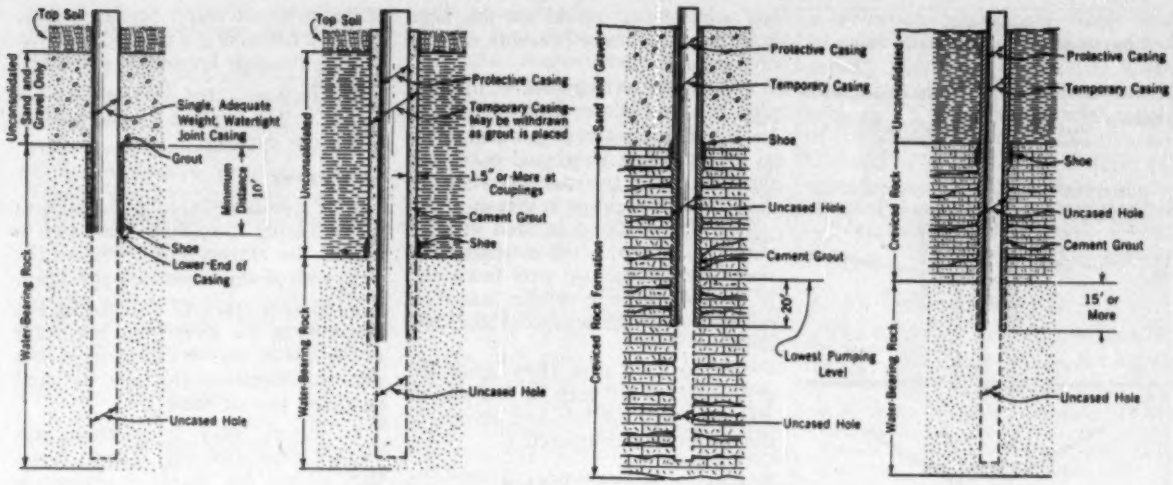
- - - To minimize interference, the distance between two wells should be twice the distance to which drawdown effects are noted during pumping.

- - - The minimum amount of interference is fixed by the cost of piping to bring the water to a central point and the cost of power transmission to the wells.

- - - Interior wells in a group should be farther apart than exterior wells because of the greater interference effect.

c. Where there is a distinct channel and direction of flow in an aquifer, wells should be placed in a line transverse to the line of flow, close enough to minimize costs, but not too close to set up excessive interference.

d. Proper spacing of wells must



Types of Well Construction in Consolidated Formations
(Reproduced from AWWA Specifications for Deep Wells)

Type VI—Single casing with 10' grout protective collar to prevent entry of sand or pollution

Type VII—Preferred over type VI for a more adequate protection of grout collar against corrosion and pollution

Type VIII—Incorporates proper deep grouting of wells in channelized or creviced rock formations

Type IX—Comprises the safest grouting to seal out water from creviced rock, above water bearing formation

be determined by experience in each well field.

e. Wells pumped by suction should be close together.

f. Wells near a property line must be located so that the drawdown effect will not pass beyond the water works property.

6. RANNEY WELLS

a. Collector wells are particularly successful in the saturated ground near the shore of a lake or river. Some have actually been constructed under the bottom of lakes.

b. Where more than one well is required, spacing should be governed by minimum interference consideration.

C . . . Construction of Wells

With the exception of some dug wells, all wells are circular holes into the ground with an impervious solid lining material called a casing.

1. SHALLOW WELLS

a. *Dug wells* are generally excavated by hand tools or excavating equipment and if the walls will not stand without support, they are lined or curbed with a water-tight lining near the top to keep out surface pollution and with a pervious lining at the bottom to allow water to enter.

- - - Dug wells are usually 3 to 4 ft in diameter and may be from 10 to 50 ft deep, although deeper dug wells are known.

b. *Driven wells* of 1 to 3 in. in diameter are constructed by driving a pipe casing on the end of which is a driving point; above the point is a screen through which water can enter.

- - - Driven wells more than 6-in. in diameter are constructed by driving an open-end casing into the earth and removing the materials by boring, drilling, sand bucket, bailer, or orange peel bucket, etc., depending on the size of the hole.

- - - Driven wells are constructed only in unconsolidated soils.

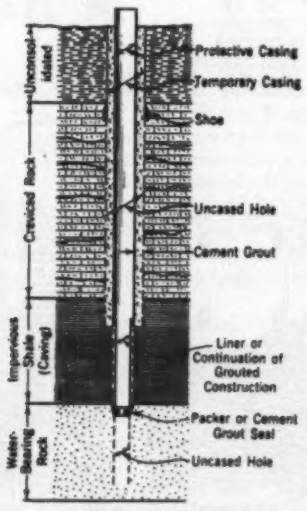
c. *Caisson wells;* the caisson method of constructing wells is used for holes 4 to 6 ft and up to 50 ft or more in diameter.

- - - Excavation takes place slightly in advance of the bottom of the caisson (or barrel of the well) which may be steel or concrete and as the excavation proceeds the caisson sinks of its own weight.

d. *Drilled wells* are constructed by employing a drilling rig in which a drill is alternately raised and dropped in a descending hole; (i.e., percussion drilling) or by jetting drills.

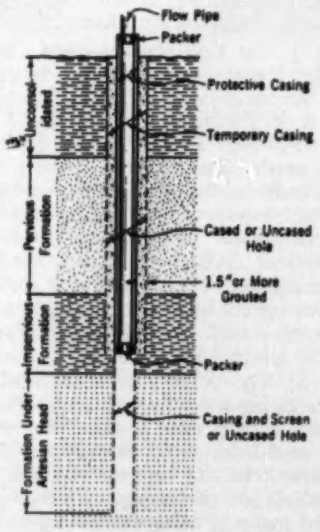
e. *Bored wells* may be from 1 to 36 in. in diameter and are constructed in unconsolidated materials.

- - - Boring is accomplished by augers which are raised for cleaning when filled. The casing is placed when the auger reaches the water bearing stratum.



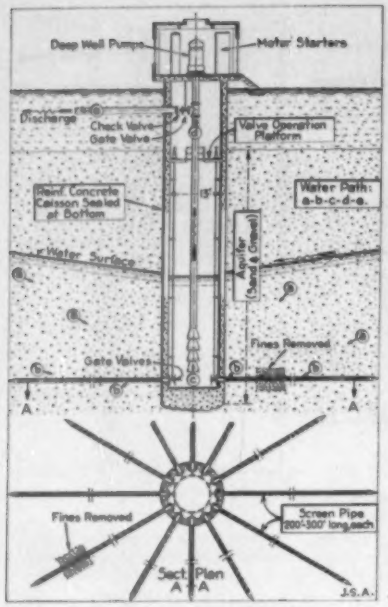
Consolidated Formation
(AWWA Specifications)

Type X—A variation of protective grouting and sealing of casing at juncture with water bearing formation



Artesian Condition
(AWWA Specifications)

Type XI—Arrangement of flow pipe, casing, packer and grout seal



The Ranney Water Collector

Sometimes called a "water-mine" is a combination of dug well and radial driven wells has come into the picture in recent years to provide large volumes of water

2. DEEP WELLS

a. Deep wells in unconsolidated materials may be constructed as driven wells, caisson wells or drilled wells, but practically all deep wells to an artesian aquifer are constructed by drilling.

b. Drilled wells may be constructed by one of five methods, depending on geologic conditions encountered.

(1) The *standard method* involves percussion drilling as described above, or some modification thereof.

(2) The *California method* (also called the stovepipe method) is used in unconsolidated alluvial deposits. In it, hydraulic jacks push casing of 10 to 14 gage steel (24 in. long) into the earth. Two diameters are used, one inside of the other, overlapped and locked together. The casing is kept ahead of the soil material as it is removed. When the casing reaches the aquifer, to admit water slotted holes are cut in the casing in place by use of a tool, designed for the purpose, which is lowered into the well.

(3) The *Rotary method* consists of rotating the string of casing which has a cutting shoe at the lower end. A mud-laden fluid is pumped into the well to rise between the side of the hole and the casing, with the loosened material being carried up to the surface.

- - - The rotary method is particularly useful in unconsolidated material of fine texture and the mud-fluid has a plastering effect on the bore hole, as it rises and prevents cave-in of the hole.

(4) In the *Jetting method*, the drill pipe has a nozzle or drill bit on the lower end and water is pumped down to loosen the material and carry out the fines, while the casing lowers under its own weight or is driven.

(5) *Core drilling* is used in hard strata. The core drill consists of a ring of diamonds or steel teeth and is rotated rapidly while water is pumped down to wash out the particles.

- - - The solid core rises inside the drill ring. This core is broken off and used as a sample and record of the material encountered.

3. GRAVEL PACKED WELLS

a. Gravel-wall or gravel-packed wells are constructed in areas where fine sands exist. Their purpose is to increase the contact between the well and the water stratum, thus increasing yields and lowering the velocity of water entering the well casing.

b. Gravel may be placed by several methods:

(1) Drill well to take a large outer casing, insert and center a smaller casing of desired size, fill the annular space with gravel, and pull the outer casing.

(2) Drill the hole 4 to 6 in. larger than the casing, fill the annular space with gravel which sinks with the casing.

(3) Undercut the end of the casing by hydraulic jetting or by an expanding reamer; (drilling mud is used in this operation to prevent cave-in.)

- - - The screen is then placed on the end of the casing and the enlarged area is filled with gravel through an outer casing.

c. Selection of the proper size of gravel is important and should be related to the size of sand particles in the aquifer.

d. Gravel-wall wells cost more than ordinary deep drilled wells, but the increased yield and longer life often justify the added expense.

4. CASINGS

a. A casing is the lining of a well; usually it is a special type of iron or steel pipe having screwed ends and couplings.

b. Casings may run to the entire depth of the well, but holes drilled through solid material may not require casing.

c. Purposes of casings included: (1) prevention of collapse of the hole, (2) exclusion of undesirable water from entering the well, (3) prevention of contamination from surface waters, (4) prevention of loss of water to non-water bearing strata, and (5) furnishing a method to allow drilling through unsuitable materials.

d. The upper ten feet or so of a casing at the surface of the well is called the curbing.

5. SCREENS

a. A screen is placed at the bottom of the casing to exclude sand and to permit the entrance of water to the well with a minimum loss of head.

b. Size, shape and spacing of the openings in the screen are important to the life of the well and must take into consideration the size of sand particles, loss of head, etc.

c. Screens may be slotted, perforated pipe (usually Monel, Everdur, silicon red brass, or Anaconda red brass) or wound wire on a frame.

- - - Openings should be shaped to prevent bridging of sand particles and clogging; they may be large enough to pass 70 per cent of the fine sand, if it is of uniform particle size; they should be large enough to keep the velocity of water flow into the well below 0.25 ft per sec.

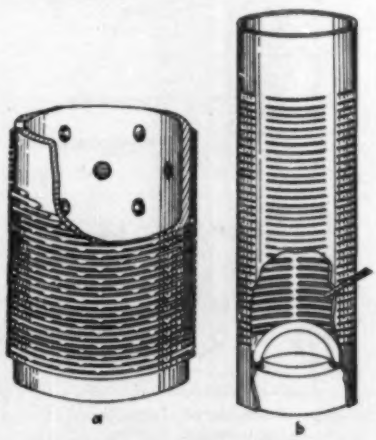
6. DIAMETER AND DEPTH OF WELL

a. In deep wells the minimum diameter may be set by the equipment required to reach the desired depth.

b. While there is some correlation between diameter and capacity, it is neither direct nor great. Babbitt and Doland in "Water Supply Engineering" (p.96) give this table.

CORRELATION BETWEEN CAPACITY AND DIAMETER OF DRILLED WELLS

gal per min	Dia. in.
50	6
50- 300	8
300-1000	10
1000-1500	12
1500-2400	15
2400-3000	20



Typical Modern Well Strainers

The Layne Strainer is on the left and Cook Strainer on the right.

c. There is *no* correlation between the depth of a well and its capacity or yield.

- - - The degree of penetration of the well into the aquifer, however, does have a relation to the capacity of the well. Generally speaking, if an aquifer is 100 ft deep, penetration to the full depth will produce twice as much water as penetration to half the depth.

7. RANNEY WELLS

a. The Ranney Water Collector is usually a caisson type dug well, 13 to 15 ft in diameter. When the caisson reaches the water bearing strata, 12 radial screens are driven horizontally into the aquifer.

b. Fines are removed from the horizontal tunnels around the screens and replaced by gravel to surround the screens, which are usually from 200 to 300 ft in length. (See illustration)

8. PROTECTION PRACTICES

a. Good sanitary engineering practices demand that all wells be protected against the entrance of pollution or contamination.

b. Private household wells, particularly dug wells are most susceptible to surface pollution. The U.S. Public Health Service has issued illustrated recommendations and instructions for proper construction of small household wells.

c. Several states have legal restrictions and laws which affect the construction of deep wells and most state health departments require cemented well casings in municipal water supply wells.

d. The U.S. Public Health Service has issued a "Sanitation Manual for Public Water Supplies" which covers such points as: (1) Surface water exclusion, (2) Earth formations above the aquifer, (3) minimum distances to contaminating sources, (4) Depth of casing and curbing, (5) Cementing or grouting of curbing, (6) Depth to gravel in gravel-wall wells, (7) Well seals or covers, (8) Vents, etc.

9. WELL SPECIFICITIONS

a. Before letting a contract for the construction of a well, specifications should be drawn.

b. The American Water Works Assn. has developed a set of well specifications which cover such items as: (1) Guaranteed output with a penalty and bonus clause, (2) Guarantee of alignment, (3) Specified screens, (4) Size, type, and weight of casing, (5) Protection against contamination, (6) Records of strata encountered, and (7) Methods of developing and testing to be used. (See —"Specifications for Deep Wells" Jour. AWWA., Sept. 1945.)

D . . . Reference Material

The following sources give detailed material and discussion of the topics covered in this lecture:

A.W.W.A.—Tentative Specifications for Deep Wells (Jour. AWWA., Sept. 1945)

Babbitt & Doland—Water Supply Engineering (McGraw-Hill Book Co.)

Bennison—Ground Water, Its Development, Uses and Conservation (Edw. E. Johnson, Inc.)

Hardenbergh—Water Supply and Purification (International Textbook Co.)

Steel—Water Supply and Sewerage (McGraw-Hill Book Co.)

U.S.P.H.S.—Sanitation Manual for Public Ground Water Supplies.

Next Lecture

SOURCE OF SUPPLY: Part 5, Capacity, Operation and Maintenance of Wells.

"Kit" Kittrell Enters Commercial Field

F. W. ("Kit") Kittrell has recently become associated with Frederic B. Stevens, Inc., of Detroit, as Process and Sales Engineer on waste disposal.

A 1923 Chemical Engineering graduate of N.C. State College, Kittrell obtained an M.S. in Sanitary Engineering at Harvard in 1933, where he received the Herschel Award and was elected to the Delta Omega (Honorary) Fraternity.

After five years as research chemist with the Standard Oil Co. (Indiana), Kittrell entered the public health field with the North Carolina State Board of Health in 1929. He was employed by the Tennessee Dept. of Public Health, 1930-41, when he became Chief, Stream Sanitation Sect., Tenn. Valley Authority. For the past two years he has engaged in radiological safety and radioactive waste disposal with the Atomic Energy Commission at Oak Ridge, Tenn.

"Kit" represents the Kentucky-Tennessee Industrial Wastes and Sewage Works Association on the Board of Control of the Federation of Sewage and Industrial Wastes Associations. He has been a recipient of the Bedell Award and the Eddy Medal.

Stevens, an old line metal plating equipment and supply company, recently has entered the plating waste disposal equipment and supply field. Mr. Kittrell will specialize in the sanitary engineering phases of the company's new program.

Sewage and Stream Biology Courses Planned in Germany

Two courses will be given in Germany during 1954 on sewage biology and stream sanitation: an introductory course March 8-12, and an advanced course October 4-8. For full details regarding cost and coverage of these courses, write to Prof. Dr. H. Liebmann, Bayerische Biologische Versuchsanstalt, Munchen 22, Veterinarstrasse 6, Germany.

A Little Appreciated Fact

"WATER is *one* natural resource which can *not* be conserved by abstaining from using it."—*Malcolm Pirnie.*

AWWA's "Prexy" and Mrs. Cunningham Receive Southwest Section Memento

During the recent annual meeting of the Southwest Section of the Am. Water Works Assn. the section honored its "favorite son," Morrison B. Cunningham, Supt. and Engr., Oklahoma City's Dept. of Water and Sewage, currently president of the parent association, and Mrs. Cunningham. The snapshot shows "M.B." and Mrs. C. posing for the photographer with the handsome and appropriately engraved silver tray presented to them as a memento of office and a display of the high esteem and affection which the section's membership holds for their No. 1 member.

It is believed that President Cunningham is the first Southwesterner to attain this high office in the A.W.W.A.

COMMENTARY

Highlights in the History of Biological Sewage Treatment

by DR. KARL IMHOFF, Consulting Engr., Essen, Germany
(Translated by C. E. KEEFER, *Editorial Associate*)*

FOR hundreds of years it has been known that polluted water purifies itself when it is employed to irrigate fields used for agricultural purposes. The water becomes purer if it simply trickles over sloping grass land. Purification becomes even more complete if the water sinks entirely into the ground and flows from a drain as filtered water.

Sewage Farms

It was only one hundred years ago that England's collieries, iron industries, and textile industries intolerably polluted the small rivers of that country.

The first sewage farms for purifying municipal sewage originated in connection with English cities. At the same time thought was given to utilizing the fertilizing material in sewage, which was useful for enriching farm lands.

This idea of sewage utilization held sway in England during the first decade of the past century. Through a statute dated 1858, it became possible for English cities to transport sewage a considerable distance for farming purposes. A Parliamentary commission investigated the matter with the hope that municipal taxes could be reduced through the profit from farming. Extensive laws relating to the utilization of sewage were passed in 1865 and 1867.

Almost all English cities little by little planned sewage farms for treating their sewage. Then the idea shifted to foreign countries. An English cooperative association even signed a lease with the German city of Danzig, wherein the association agreed to operate sewage farms and to pay the cost of pumping. The first German sewage farm was built in Danzig, and soon thereafter Berlin and other German cities followed suit.

Land Requirements Became Excessive

Corresponding to the need of land enrichment, the technique of the first English sewage farms was centered entirely on broad irrigation. This was planned to apply no more fertilizing material to the land than plants could use. Undrained meadow land was first used for the purpose. In 1854 the health authorities recommended that sewage be distributed over the land with sprinklers, and moreover that garden hoses be used. The sewage load thus treated was only 12 to 20 persons per acre.

The large areas of land required for such treatment were not available in the neighborhood of English cities. The cities soon saw themselves compelled to make do with smaller areas. They provided the sewage farms with good networks of trickling facilities and conveyed to the fields quantities of water and fertilizing materials too great to be fully used by plants. In this treatment, authorities calculated on a sewage load of from 80 to 200 persons per acre of land. The interests of farming had to give way to those of sewage treatment.

Farming Still Used

Sewage farms of this modern type proved their excellence in many German cities such as Berlin, Freiburg and Munster, because they could be located on sandy soil. But in England, where clay soil predominates, almost all municipal sewage farms have eventually failed. The water cannot trickle away; it remains on the ground; farming is adversely affected; the sewage is poorly treated; and the neighborhood is annoyed by odors.

Most English sewage farms have been abandoned. First the cities turned to chemical precipitation, but this method of treatment did not prove satisfactory. Finally, the cities were forced to develop new, artificial, biological treatment methods, which utilized smaller areas. Today, remaining sewage farms still serve English cities for disposal purposes where the land areas are large, and some of them serve a good purpose in drying and utilizing sludge.

Intermittent Sand Filters

Sir Edward Frankland, an Englishman, applied a new idea to the problem of those sewage farms having inadequate areas. Frankland was a member of the Royal Sewage Commission, founded in 1868. His ideas were published in the third report of this commission in 1871. The weaknesses of chemical purification were acknowledged in that report, and sewage farms were designated as the only servicable treatment method for sewage.

It was recognized, however, that their surface loading must be increased. With the *continuous* addition of sewage that was not possible, even through the use of coarse grained soil.

> *"Finally, the cities were forced to develop new, artificial biological treatment methods which utilized smaller areas."*

* Mr. Keefer is Deputy Sewerage Engineer, Bureau of Sewers, Baltimore, Md.

"To maintain the purifying effect of the soil, the bacteria must be kept alive by aeration."

One must above everything else provide for the aeration of the soil, for the soil functions like the lungs of an animal. It is best to irrigate each area every third or fourth day, and then occasionally to introduce a long period of aeration. The surfaces of the beds so used cannot be planted.

Frankland named his treatment "intermittent filtration." This method of treatment was tried in many English cities. It was satisfactory nowhere, possibly because the English sewage farms did not consist of sandy soil.

Americans Perfect Sand Filters

Frankland's intermittent sand filters would be forgotten if American health authorities in Massachusetts had not experimented with them 15 years later at the Lawrence Experiment Station. These investigations completely justified the utility of sand filters.

Specialists at the experiment station so completely perfected the intermittent treatment from 1887 to 1897, that during the following 50 years nothing new could be reported. The treatment was quickly adopted in 23 American cities, one after the other. Likewise many German cities later followed the same procedure, if suitable beds of sand were available.

It is unquestionable that properly operated intermittent sand filters can produce the best effluent of all known sewage treatment methods. The required area is only about one-tenth of that of the usual sewage farm, for one acre of surface area can treat the sewage from 800 to 2,000 persons. The only disadvantage of these filters is that considerable hand labor is necessary to service them.

Trickling Filters

Trickling filters were the next form of biological treatment to originate from intermittent sand filters. Once it was recognized that the cultivation of the surface was not necessary to maintain the purifying effect of the soil, but only that the soil bacteria must be kept alive by aeration, the way was open for the next step. Large areas no longer were needed, but a biological treatment bed could be constructed artificially. Instead of fine sand, coarse grained material which permitted suitable aeration was used.

In early developments the wrong procedure was followed by exactly imitating intermittent sand filters. So-called contact beds were designed; these were filled two or three times daily and then were emptied to aerate them. Contact beds were built in London in 1892 by the engineer, Santo Crimp, and the chemist, Dibdin. They were then adopted for use by many large English cities.

But contact beds have the great defect of retaining the sludge resulting from biological purification. In a few years of operation, the beds became filled with sludge to such a degree that the entire contents had to be removed and cleaned with water sprays. This work proved to be quite costly, and today contact beds are forgotten.

In 1893, almost at the same time that London installed contact beds, the English engineer Joseph Corbett, took the proper course at Salford. He invented the trickling filter, which stands in the open air and through which sewage trickles continuously. The stone can be of any suitable size. The only special requirement is some sort of an apparatus designed to equally distribute the sewage on the entire surface of the filter. Corbett employed for this purpose spray nozzles, traveling and rotating distributors—and similar units still prove their worth today.

Increased Surface Loading Accomplished

Trickling filters succeeded once more in increasing significantly the surface loading as contrasted with intermittent sand filters. The sewage from 30,000 to 40,000 persons can be treated on one acre of most English trickling filters 6 ft. deep. Today trickling filter designs are calculated on the basis of persons served per cubic yard of filtering material. A surface loading of 30,000 to 40,000 persons per acre corresponds to a volume loading of 3 to 4 persons served per cubic yard of filtering material.

Trickling filters won world-wide acceptance, especially through the efforts of William Phillips Dunbar, the German doctor and sanitarian, who was born in America. Durbar, through his experiments in Hamburg, created designs and wrote scholarly books providing a basis for biological sewage treatment in the years 1892 to 1914.

An advance in the construction of trickling filters developed in the years from 1933 to 1937. During those years, experience was gained at the same time in America, Germany and Russia, demonstrating that one could load trickling filters much more than was customary. Since then, high-rate trickling filters with a loading of 15 to 20 persons per cubic yard of filtering material have been differentiated from low-rate filters, which continue with a loading of 3 to 4 persons per cubic yard.

For this differentiation, the American bacteriologist, H. O. Halvorson, has given a pertinent explanation: every trickling filter built of coarse filter media with good natural bottom aeration can be a high-rate filter if so much sewage is applied (a surface loading in excess of 20 mgd per acre) that the effluent continually washes through the biological sludge. If the washing effect is too small, the sludge remains in the filter medium; when it does, it must be oxidized in the filter, and therefore the filter must be larger. Then the loading is only 3 to 4 persons per cubic yard instead of 15 to 20 persons.

Activated Sludge Treatment

The treatment of sewage with activated sludge had its beginning in 1912. In that year, the American chemist, H. W. Clark, experimented with the purification of sewage in aerated containers at the Lawrence Experiment Station of the Massachusetts State Department of Health. The containers were regularly filled and paritally emptied, leaving some of the sludge which was *activated* by aeration (that is the essential feature) continuously remaining in the containers.

An Englishman, Dr. G. Fowler, of Manchester, saw these experiments in November, 1912. After his return, he developed the activated sludge process in its present form with his fellow workers Ardern and Lockett and the engineer, Walter Jones.

The "fill-and-draw treatment" which was used by Clark, was developed by these workers into "continuous-flow treatment."

"Every trickling filter can be a high-rate filter if so much sewage is applied that the effluent continually washes through the biological sludge."

Accelerated Natural Purification

Activated sludge treatment is best understood, if one represents it as concentrated self-purification as one knows that process from an understanding of polluted water. The same microorganisms responsible for the purification of river water are also active in the aeration tank of an activated sludge treatment plant, only they are concentrated in enormous numbers. Following the aeration step they are separated as sludge in a secondary settling tank and then are again returned to the aeration tank.

The sludge increases continually and a part of it must be removed daily as surplus material. The disadvantage of this treatment is that excess sludge has a high water content and, accordingly, is difficult to handle.

The first large cities to adopt this method of treatment were those of Milwaukee and Chicago. In both these cities the sludge was dewatered on vacuum filters and then heat dried for fertilizer purposes. The first German plant (in operation since 1926) was in the Ruhr District in Essen-Rellinghausen, serving 50,000 persons. In the latter plant the sludge problem was solved by pumping the dilute sludge into the inlet to the primary settling tanks, where it mixes with the primary settling tank sludge. The mixed sludge accordingly loses the greater part of its water content, and can be handled without difficulty in sludge digesters in the usual manner, and can be easily dried on sludge beds. For the most part, this treatment of excess sludge is practiced in all countries.

Activated sludge treatment has surpassed all other biological treatment processes in technical and economical respects. It is estimated that the sewage from 15 persons can be treated in 1 cu. yd. of aeration tank space in the case of a lightly loaded plant, and 30 persons in the case of a heavily loaded plant.

Ponds and Lakes

Natural or artificial ponds or lakes offer a very suitable means for the biological treatment of sewage or polluted river water. Large water surfaces exposed to air and light furnish a favorable environment to the smallest plant-like growth, which are responsible for carrying out purification.

Fifty years ago Hofer proposed to build fish ponds in Munich for the purpose of purifying sewage. He successfully promoted experimental plants of this type in several German cities. Since 1926 a large pond of this kind has been in operation in Munich.

The sewage is given preliminary treatment in Imhoff tanks, is diluted five-fold with river water, and is purified biologically in ponds having a two-day detention period. In winter months the ponds are taken out of operation, and the sludge is removed. The removal of the pond sludge corresponds to the withdrawal of excess activated sludge in activated sludge plants.

Without regard to the breeding of fish, many sewage ponds are in use in other places in Germany as a biological means of treating sewage; in the Ruhr District, the Weisselster District and the Mulden Water District. In the sewage pond at Lennep in the Wupper District, oxygen is added during the summer months by artifiical aeration of the water.

Oxidation Ponds for Waste Treatment

In the United States, oxidation ponds have been used in recent years for the biological treatment of industrial wastes. The sludge is removed from the sewage in primary settling tanks, and the settled sewage is discharged to ponds about 3 ft. deep having more than a week's detention period. Generally it is not possible to dilute the sewage with water, and sodium nitrate, which provides oxygen, is added to prevent the ponds from becoming septic. The sludge is removed from these ponds each year.

Only the upper layers of water in deep ponds and lakes are suitable for sewage purification. Deep lakes have the disadvantage that the micro-organisms, first multiply greatly because of the fertilizing characteristics of the sewage, then die and accumulate on the bottom as a putrid mass. This superimposed layer of sludge can not be easily removed—as it can in artificial treatment methods. As a result, it gradually deteriorates higher strata of lake water because of a lack of oxygen.

At Lake Bret, which serves the city of Lausanne, Switzerland, with drinking water, it has been necessary since 1947 to artificially maintain the oxygen balance in the lake water. This is done by withdrawing the water from a depth of 46 ft., enriching it with oxygen by spraying it into the air and then returning it to the lake. The treatment corresponds in principle to the above-described aeration of pond water in Lennep.

In 1927 the Ruhr District built the first dam, forming Hengstey Lake in the Ruhr Valley, which has the function of purifying the polluted river water. It also was the first dam to be supported by means of voluntary water power agreements. The purification effected costs the members of the District nothing. Hengstey Lake is followed by three larger Ruhr lakes.

All lakes on the Ruhr have proved their worth technically and economically. The disadvantage associated with deep lakes have not been in evidence in the Ruhr valley. These lakes are so shallow that the sludge produced by biological processes flows out yearly with high water. Two similar dams have also been built by the Weisselster District in Saxony.

From the possibilities indicated by the examples cited, it appears that more use should be made than heretofore of ponds and lakes to purify sewage or polluted river water.

Citrus Waste Treatment Studies at the Univ. of Florida

A new series of investigations aimed at the treatment of citrus wastes is being initiated under the direction of Dr. J. B. Lackey of the University of Florida. Although citrus wastes show great variability in strength, all are high in carbohydrate materials and low in nitrogen.

Using this common characteristic as a point of attack, the studies are directed toward finding the groups of organisms and proper environmental conditions for economically oxidizing the waste. Species of bacteria, yeasts, higher fungi and protozoa have been identified from experimental filters dosed with neutralized waste. Some of these are known to attack components of the waste with great vigor. Organisms which will cause the greatest B.O.D. reduction with the least preliminary treatment are to be studied.

Most of the previous investigations into the problems of citrus waste have been directed toward by-product recovery. Although this is a laudable approach to any industrial-waste problem, the resulting effluents in this case still produce serious pollution problems. Preliminary work has been done on this combined laboratory and field study. Plymouth, Florida, is the site of the field investigations.

Report of the S&IW Federation's 26th Annual Meeting in Miami

II—Industrial Wastes and Operators' Forum Sessions

THE first installment of this report on the meeting of the Federation of Sewage and Industrial Waste Assn. in Miami, October 13-16, 1953, appeared in our December issue. It recorded the highlights of a busy and successful meeting, the new officers elected, honors and awards presented, social events, and many other features.

That report included reviews of three technical papers: a description of the sewage treatment plant now under construction for the city of Miami; an evaluation of design criteria applicable to semi-tropical climates; and a consideration of the lake disposal of sewage effluents.

This installment reviews the industrial waste forum and plant operators' forum sessions, and additional technical sessions.

Industrial Waste Forum*

The importance of industrial waste problems was again emphasized at this year's Federation Convention in Miami, with the popular Industrial Waste Forum as a part of the program.

DON E. BLOODGOOD, Prof. of Sanitary Engineering, Purdue University, was leader of the Industrial Waste Forum. Four topics were scheduled for discussion, with each topic being introduced by a previously selected speaker. Floor discussion followed each topic.

In opening the session Prof. Bloodgood quoted L. L. Hedgepeth, who wrote in *Water & Sewage Works*, "You can't talk pollution out of a stream." Bloodgood further commented that everyone seemed to agree that "stream pollution ought to be stopped, but how and to what extent are questions still under argument."

*Reported by George E. Symons, Ph.D., Consultant & Technical Editor, Larchmont, N. Y.

Presiding

Wastes Forum
Don E. Bloodgood
Prof. San. Eng.
Purdue Univ.
Lafayette, Ind.

Industry Session
L. J. Fontenelli
Superv. Engr.
Rahway Jt. Meeting
Garwood, N. J.

Stream Usage

"CRITERIA FOR STREAM USAGE," the first topic, was presented by Harold Jacobs, Waste Consultant, E. I. DuPont DeMemours & Co., Wilmington, Del.

Mr. Jacobs said that he does not favor rigid standards, either for a stream or an effluent; in short, the use of standards expressed in ppm is unwarranted and unwise. Stream pollution abatement should have broad objectives, with all improvements being the result of cooperative efforts by all concerned. Mr. Jacobs cited several examples of water use and treatment of wastes necessary to meet these uses:

1. *Navigation* requires the lowest treatment of wastes; oil and settleable solids should be removed from wastes and the pH adjusted to approximately neutral; H_2S should be absent.

2. *Agriculture* requires that the pH be adjusted, settleable solids removed and excess concentrations of sodium ions reduced.

3. *Industrial Use* cannot tolerate the poorest quality water. For example, high chloride ion concentrations can be injurious at high temperatures on stainless steel and low pH is likewise injurious to iron and steel, etc.

4. *Fish Life* requires that waters be free from toxic substances, but the B.O.D. of wastes is not directly important except as it may cause a reduction in dissolved oxygen.

5. *Recreation* and, in particular, swimming have as the important criterion the number of coliform organisms present; 2400 per 100 ml being the usual standard in the stream.

6. *Potable Water* requires the highest stream pollution abatement measures. There should be few coliform organisms present, no taste and odor producing substances, no toxic compounds, etc.

Mr. Jacobs pointed out that it sometimes cost more to treat a waste discharged into a water course than it would cost to treat water for removal of that waste in a water plant using that stream for domestic water supply. Therefore, said Mr. Jacobs, "Let the industry pay for the cost of water treatment for removal of that particular waste instead of installing waste treatment facilities at the industrial plant."

In closing this presentation of the topic of stream criteria, Mr. Jacobs suggested that it was unwise, and even impossible to return all streams to their pristine purity.

DR. CLAIR N. SAWYER, Prof., San. Chem., M.I.T., Cambridge, Mass., asked how it could be managed to assign responsibility between waste treatment and water treatment by a domestic supply. Mr. Jacobs replied that it is impossible to generalize; but in particular cases, for example, in the case of phenols it is easy to decide how much of the extra cost of water treatment is caused by the presence of waste and thus assign the responsibility to the industry.

LADIES EVENTS included a boat ride around the islands and through the Canals of Miami Beach

M. P. Adams
Secretary
Stream Control Comm.
Lansing, Mich.

C. N. Sawyer
Prof. San. Chem.
Mass. Inst. Tech.
Cambridge, Mass.

Hayes H. Black
Chief, Ind. Wastes Sec.
U. S. P. H. S.
Cincinnati, O.

G. E. Symons
Consultant
and Tech. Ed.
Larchmont, N. Y.

Industrial Wastes Forum

DR. GEORGE E. SYMONS, Consultant and Technical Editor, Larchmont, N.Y., asked how such an arrangement could be legally effected since the municipality is supported by tax monies, and the industry by private enterprise. Mr. Jacob's only answer was, "Make it open and aboveboard."

HAYES BLACK, Chief, Ind. Waste Sect., Public Health Service, Cincinnati, Ohio, commented on this idea that the industry pay for part of the cost of water treatment; he suggested that this was a good sign and he believed that perhaps the Federation should hold a joint meeting with the Amer. Water Works Assn. to discuss these many mutual problems.

MILTON P. ADAMS, Exec. Secy., Water Resources Board, Lansing, Mich., stated that generalities often did not apply to specific situations. Adams cited the State of Michigan where there exist not only large cities, but also international pollution problems.

Dilution Factors

"WATER DILUTION FACTORS IN RELATION TO TREATMENT OF INDUSTRIAL WASTES," the second topic on the Forum, was introduced by Dr. Richard Hoak, Senior Fellow, Mellon Institute, Pittsburgh, Pa.

The literature on stream pollution and industrial waste abatement contains little information on the subject of dilution. It is generally assumed by workers in the field that dilution is beneficial, but the matter is not that simple. It used to be said that 3 to 4 cfs per 1000 persons was enough to overcome nuisance conditions in a stream and up to 10 cfs per 1000 persons for aesthetic purposes. These figures are applicable only when dissolved oxygen is the limiting factor. For bacterial conditions, dilutions up to 500 times may be needed to make the water amenable to ordinary treatment.

The assimilating capacity of a stream can be determined by survey and it usually will be found that dilution is not the single answer, especially in the case of industrial wastes. Low flow augmentation can be one of the reasons for a multiple purpose dam, but it is not sufficient to warrant the construction of a single purpose dam.

Dams for flood control sometimes create a pollution problem. Hoak cited the Clarion River studies which showed that a flood control dam acted as a settling basin. In the summer this reservoir actually imposed a B.O.D. on the river, creating a nuisance due to the decomposition of the sludge solids deposited behind the dam during the year.

Hoak also cited the upper Ohio River, where acid mine wastes inhibit bacterial activity. If these wastes were taken out, there would be one giant cesspool in the river. Dilution would not be the answer.

Stream Standards

"POLLUTION ABATEMENT ON THE BASIS OF NATURAL PURIFICATION CAPACITY ON SECTIONS OF STREAMS VS. ENTIRE STREAM" was the title of the third topic on the Forum. Presenting this subject, F. W. Kittrell, Process and Sales Engr., Frederick B. Stevens, Inc., Detroit, Mich., interpreted this rather involved title to mean "Standards for an Entire Stream versus Section Standards."

To illustrate his points, Mr. Kittrell had drawn a sketch of a stream showing various uses, including fishing, power generation reservoir, swimming, public water supply, and navigation. Kittrell then showed how it was impossible to set standards that applied to the entire stream, but quite feasible to set standards for each section use.

FRANK W. JONES, Partner, Havens & Emerson, Cleveland, Ohio, asked if one user should be penalized in order that another can have free use of a stream. Mr. Kittrell replied that the capacity of a stream to assimilate wastes should not be lost, nor should it interfere with other uses. Use of a stream for disposal should take its place in the table of water uses.

WILLIAM H. LARKIN, Chief, Water Pollution Control Sect., N. Y. State Health Dept., Albany, N. Y., stated that New York State recognized that simple zoning is not always possible; one zone may have multiple uses. It is New York's philosophy to pick the use that best serves the community; i.e., pick the highest use for the area.

LINN H. ENSLOW, Editor, *Water & Sewage Works*, asked Mr. Larkin if the New York law permitted a stream to be rezoned, after it had once been zoned, and if so, how long did it take to effect the rezoning. Mr. Larkin replied that rezoning was possible and that the time required was only that for conducting public hearings, to legalize the hearings, and to act.

Stream Standards vs. Effluent Standards

"STREAM STANDARDS VERSUS EFFLUENT STANDARDS IN CONTROL OF INDUSTRIAL WASTES POLLUTION," the last topic on the Forum, was introduced by G. R. Herzik, Chief Engr., Texas State Health Dept., Austin, Tex.

Mr. Herzik stressed the fact that this question was the "ogre" of stream classifications. In Texas there is only one classification, the highest. Regarding his own State's conditions, Mr. Herzik stated that the benefits of clean water are important to the whole State, and the law under which his agency operates is the basis of the criteria of stream classification. Since it is the law, Mr. Herzik believes it should be enforced.

Any stream pollution agency, particularly that in Texas, is the policeman, but should not be the judge and jury as well. The law in Texas says industry cannot put anything into streams, therefore, all streams are Class A. Naturally there are pressure groups who wish the law interpreted to suit them, some are even defiant, but Mr. Herzik believes in approaching these problems with an "open mind instead of an open mouth."

ROY WESTON, San. Engr., Atlantic Refining Co., Philadelphia, Pa., asked Mr. Herzik where there was an example of a successful working program. Mr. Herzik replied that he did not know of any. Then Mr. Weston raised the question: are not stream standards necessary and does not a stream standard imply or mean an effluent standard? Mr. Herzik said essentially the two are the same and therefore there is stream classification. Next Mr. Weston asked if we are listening

to John Q. Public enough, and Mr. Herzik said he thought so, but he added that just because stream standards are good in New York State does not necessarily mean that they are also good for Texas, or any other particular state.

GEORGE RHAME, Wat. Poll. Cont. Engr., So. Car. Wat. Poll. Cont., Auth., Columbia, S. C., asked how Texas gets nothing but pure water in all streams, to which Mr. Herzik replied that they are still trying to get rid of some wastes.

DON LEONARD, U. S. PHS, Washington, D. C., commented that some states classify their waters by legislation, rather than by stream pollution control engineers and agencies. This is what they have in Texas, and this usually results in all streams being classified as Class A waters.

KENNETH S. WATSON, Coordinator of Waste Treatment, General Electric Co., Schenectady, N. Y., made three pertinent comments regarding the whole subject of waste treatment: (1) The principle of treating water instead of waste is another way of voicing the fundamental fact that the most economical method of handling the problem should prevail. (2) Dependence on dilution for waste treatment may be expensive and not always a sound approach to the problem. (3) Everyone seems to define stream classification differently but the logical approach is to define the stream uses and pick steps necessary to keep the stream in the condition which best serves the interests of the community.

DR. W. D. HATFIELD, Supt. Sanitary District of Decatur, Ill., commented that he had experienced a case where an industry would not move into Decatur because he would not set ppm limit on wastes, preferring to resolve any problems on the basis of sound engineering practice and conditions. The lawyers for the company, however, would not consent to that approach but wanted definite standards set up before analysis of the wastes and its effects on the Decatur sewage plant could be studied and known. Here was an instance where industry was asking for standards, something that most spokesmen for industry decry.

DANIEL OKUN, Assoc. Prof. of San. Engr., Univ. of North Carolina, Chapel Hill, N. C., said that in his opinion effluent standards can become absurd; it is not the concentration of the wastes but the total load imposed on the receiving body of water.

JAMES BROWN, San. Engr., Lederle Labs., Pearl River, N. Y., expressed an industrialist's point of view that objectives for a stream are necessary but rigid standards are untenable.

R. D. Hoak
Sr. Fellow
Mellon Inst.
Pittsburgh, Pa.

F. W. Kittrell
Process Engr.
F. B. Stevens, Inc.
Detroit, Mich.

F. W. Jones
Cons. Engr.
Havens & Emerson
Cleveland, O.

W. H. Larkin
Chief, Polln. Control
State Health Dept.
Albany, N. Y.

Industrial Wastes Forum

In summing up the session, PROF. BLOODGOOD expressed the opinion that speakers had agreed that we still need improvement in the matter of industrial waste treatment and stream pollution abatement, progress has been and will continue to be slow, and in approaching the problem involved we must give consideration to many factors and many attitudes including those of the public, the law, the lawyers, the engineers, and the stream itself.

Operators' Forum*

M. E. DAWKINS, San. Engr., State Board of Health, Jacksonville, Fla., presided at the Operators' Forum. This, the final technical session, was devoted to four topics.

Manpower Evaluations

"MANPOWER REQUIREMENTS FOR SEWAGE TREATMENT OPERATIONS" was introduced by E. B. Cobb, Partner, Metcalf and Eddy, Boston, Mass., who listed factors which affect personnel needs.

Plant size is the most dominant factor when operating personnel is considered, together with the number of mechanical and labor-saving devices installed. The efficiency of personnel available often is determined by funds available for wages and salaries. Local considerations such as union arrangements, work-week limitations, and the extent to which good housekeeping is practiced are of considerable significance when studying personnel requirements.

Replying to a question from the floor, Mr. Cobb indicated that a one-man plant is not desirable, but in very small plants and in small communities there is often no other solution. Other comments indicated that sludge handling practices require improvement to reduce the time required of plant personnel. A survey in Indiana, carried out on a population basis, revealed that 30 per cent of the productive time is often required just to handle sludge.

*Reported by V. W. Langworthy, Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

Training Personnel

"TRAINING PROGRAMS FOR SEWAGE TREATMENT PLANT PERSONNEL." This discussion was initiated by W. T. Linton, Executive Director, Water Pollution Control, Board of Health, Columbia, South Carolina.

A correspondence-type course was described which may be obtained from Clemsen College. A total of sixteen lessons in water and sewage subjects is available to members of the South Carolina Water and Sewage Works Association. The lessons are prepared and examinations are corrected by members of the Clemsen faculty. Enrollment at present is in excess of 400 operators.

The state legislature furthered the project by appropriating $10,000 in 1951, after the ways and means committee had been properly informed as to the needs and purposes of such a course.

In answer to a question regarding material covered in the course, Mr. Linton reported that the present course is elementary in nature, including mathematics. Certification in South Carolina is voluntary, and eventually advanced courses are expected to be prepared at the graduate level. Each individual successfully completing a course will receive acknowledgment of that fact, signed by the president of the Clemsen College.

Plant Appearance

"LANDSCAPING AND CARE OF SEWAGE TREATMENT PLANT GROUNDS" was a subject discussed by G. T. Lohmeyer, Supt. Sewage Treatment Plant, Univ. of Florida, Gainesville, who suggested that size and type of plant, together with budget allowances, will determine the extent of landscaping.

Among the advantages of landscaping are: good appearance, less

Roy F. Weston
San. Engr.
Atlantic Refining Co.
Newton Sq., Pa.

W. D. Hatfield
Superintendent
Sewage Tr. Plant
Decatur, Ill.

Industrial Wastes Forum

G. A. Rhame
San. Engr.
State Health Dept.
Columbia, S. C.

J. M. Brown, Jr.
San. Engr.
Lederle Labs.
Pearl River, N. J.

dust, raising of employee's morale and an impression of coolness exhibited by green grass and shrubbery. Good landscaping is accomplished through the proper use of sludge and the aesthetic planting of shrubs.

It was pointed out in the discussion that lawns should be kept down to a practical size and that natural cover should be used wherever possible. Landscape architects often may be used to good advantage when proper utilization of shrubs and lawn is desired. It was also pointed out that chlorinated effluent from secondary treatment plants is in widespread use for sprinkling purposes, but primary plant effluent is probably not desirable for this purpose.

L. H. Enslow, Editor, *Water & Sewage Works,* commented that a plant that is neat and clean outside probably is the same inside. His opinion is that sewage plants in many instances look better than water plants.

Frothing Control

"Control of Frothing in Sewage Treatment" was the title of a paper in which G. E. Mau, Chief, Water Pollution Control Section, State Board of Health, Lawrence, Kansas, illustrated European and British sewage treatment plants by means of lantern slides. These illustrations included examples of landscaping and controlled froth conditions.

A prepared discussion of frothing presented by H. E. Berg, Mgr., Process Chemicals, National Aluminate Corp., Chicago, Ill., indicated that the frothing problem was here to stay, due to the conversion of the public to using synthetic detergents. It was suggested that a survey to determine the extent of the froth problem should be conducted by a trade association or other interested group.

Referring to antifoam agents, Mr. Berg explained that they should break the bubble film causing the foam and be quickly dispersed. The agent should be specific for each plant and used only when required, being applied as a spray, to the return sludge or to the raw influent. Costs vary with the local conditions, but the maximum to be expected is approximately seventy-five cents per million gallons of sewage treated.

Technical Session

Louis J. Fontenelli, Vice President, presided at a technical session devoted to papers on special industrial effluents.

Pickling and Plating Wastes

"Treatment of Complex Metal Finishing Wastes," a paper presented by K. S. Watson, Coordinator of Waste Treatment, General Electric Realty Corp., Schenectady, N.Y. described operations at the Erie, Pa. Works of the General Electric Co.

At an approximate annual cost of $105,000 wastes have been treated and a satisfactory effluent has been produced throughout two and one-half years of operation. Pickling and plating processes produce waste acids, cyanides, copper and chromium ions, in addition to process waters. Ferrous sulfate is used to reduce the chromium plating wastes. Cyanide wastes are batch-treated with chlorine and alkali, while pickle liquor is neutralized with lime. Sludge is dried on vacuum filters prior to disposal at a nearby dumping area. Experiments using fly ash as a filter aid revealed that its excessive abrasive content offset any advantage to the dewatering process.

ONE MORE fisherman and sailfish
Swede Larson, Dist. Mgr., Springfield, Ill. Sanitary District, worked 2 hr. and 25 min. for this 42 lb., 7 ft. long, prize.

Waste treatment costs indicate the desirability of in-plant studies to reduce waste volumes, as well as consideration of all equities when determining plant size. Construction costs at the Erie Works totalled $705,000, including excess capacity at present available in the acid and cyanide treatment sections for future expansion.

Rolf Eliassen, program committee vice-chairman read a discussion of Mr. Watson's paper prepared by W. S. Wise, Director, State Water Commission, Hartford, Conn.

It was emphasized in Mr. Wise's discussion that General Electric had proceeded in its waste treatment program without pressure from a state regulatory agency. Mr. Wise also referred to the chromium plating waste treatment plant at the Electrolux Corp., Old Greenwich, Conn., where sodium meta-bisulfite is used. Slides illustrated how trucks are used to haul sludge from this plant to a municipal disposal area.

Plating wastes at the Hamilton Standard Propellor plant are treated continuously with chlorine and lime. Continuous treatment facilities were included in original plant design which also involves automatic operational controls. Sludge is dried on sand beds.

Discussion from the floor revealed that pH values between 2.0 and 2.5 are used at the Erie Works for chromium reduction and that cyanides are oxidized above pH 8.5 to cyanates.

Steel Plant Wastes

"Disposal of Steel Production Wastes at the Fairless Works," a paper presented by G. A. Howell, Asst. to Chief Engr., U.S. Steel Corp., Pittsburgh, Pa., pointed out that the wastes containing oils, acids, alkalies and solids must be treated prior to discharging to the Delaware river above Philadelphia.

The treatment works is located near the river and the effluent may be discharged or may be returned to plant processes. Slides illustrated the complexity of the treatment facilities at Fairless Works, which were designed by U.S. Steel and consulting engineers.

Oil is treated in rectangular separators near points where the oil waste is produced; chromium wastes are treated in conjunction with waste pickling liquor; and alkaline wastes are flocculated with a lime slurry. Soluble oils are cracked in a flash

Metal Finishing Wastes

K. S. Watson
Waste Tr. Coordinator
G. E. Realty Corp.
Schenectady, N. Y.

W. S. Wise
Director
State Water Comm.
Hartford, Conn.

mixer and skimmed from the alkaline waste clarifier. Mill scale is flushed to collecting pits and mechanically removed, allowing the clarified rinsing water to be returned to process.

Sanitary sewage facilities are included in treatment plant design. These are designed to treat 60 gallons per capita per day from 9,000 employees.

GRANT PETIT, Industrial Waste Control Engineer, Armco Steel Corp., Middletown, Ohio prepared a discussion of Mr. Howell's paper, which was read by R. D. Hoak, Mellon Institute.

Emphasis was placed on the magnitude of Fairless Works waste treatment facilities, where the wastes are completely segregated. Incorporation of waste treatment facilities with plant design indicates the interest of management in pollution abatement. It was pointed out that research must be continued to determine the best answers to many waste treatment problems.

Utilization of pickle liquor in chromium waste treatment at Fairless represents a fortunate circumstance, since separate waste pickle liquor neutralization would greatly increase the sludge disposal problem.

Woodpulp Industry Wastes

"WATER AND WASTE IN THE WOODPULP INDUSTRY," a paper by H. R. Murdock, Chemical Engr., Infilco, Inc., Tuscon, Ariz., discussed waste problems resulting from the draft (sulfate) and sulfite pulping processes.

The period 1932 to 1938 saw a threefold increase in kraft pulp processing, while only slight gains were recorded in sulfite production. Emphasis on pollution abatement has probably been the greatest deterrent to sulfite process growth, and research is needed into ways and means to control sulfite wastes.

Slides illustrated pulp production data since 1930, comparative growth of kraft and sulfite processes since 1935, and a diagram showing how steam generation from pulp waste combustion might result in fuel economies.

A discussion of Mr. Murdock's paper was prepared by H. W. GEHM, Technical Advisor, National Council for Stream Improvement, New York, N.Y. In the absence of Dr. Gehm, the discussion was presented by W. A. Maggio of the National Council.

Solutions to pulp industry waste problems are not solved: yeast fermentation to produce alcohol, or pulp waste, as a fuel source are not the final answers. Activated sludge and chemical precipitation are possible methods of pulp processes waste treatment, but process changes to semi-chemical chemical methods offer manufacturing economies and have a direct bearing on reduced pollution.

Utilizing Sewage Effluent for Crop Irrigation

"SEWAGE EFFLUENT DISPOSAL THROUGH CROP IRRIGATION," a paper presented by J. A. Eckstein, San. Engr., Oscar Mayer and Company, Madison, Wis., reported an investigation carried out by the Department of Soils, University of Wisconsin, Madison, Wis.

The study was aimed toward determining the effect of human and industrial wastes when used for crop irrigation. Information was sought which would reveal effects on crops, soil and ground water conditions when irrigation is practiced.

Field-size irrigation installations were preceded by lysimeter studies which compared trickling filter plant effluent with city water. It was reported that 40 inches or more of sewage plant effluent can be applied to a

Florida S & I W Assn.

President
W. C. Tims
Engr.-Supt.
City of Tampa
Tampa, Fla.

F S & I W A Director
J. R. Hoy
Dist. Engr.
W & T Co.
Jacksonville, Fla.

crop of Reed canary grass, with less effluent tolerable by crops with shorter growing periods. It was further learned that the crop and soil are effective in reducing numbers of coliforms to about 100 per 100 ml. when the effluent applied contained 10 million per 100 ml.

R. A. WEBSTER, Supt. Sewage and Industrial Waste Treatment, Seabrook Farms, Seabrook, N.J., discussed the work reported by Mr. Eckstein, pointing out that 10 mgd of vegetable processing wastes and domestic sewage are utilized for woods and crop irrigation at Seabrook Farms.

There has been no evidence of soil clogging at Seabrook Farms despite the presence of 425 ppm sodium, due probably to the low pH value (5.5 to 6.0) of the waste water. Ground water levels rise and fall as the irrigation program is carried on.

Quality of the ground water has not deteriorated, as weekly checks indicate. Tests performed in 1952 indicated purification of the waste water in the first three inches of sassafras loamy soil.

Crop yields definitely are increased at Seabrook Farm as a result of irrigation; however no comparative studies have been made to evaluate the effect of fresh or surface water and the waste treatment plant effluent. It was recommended that soil permeability and capacity of the underground reservoir be thoroughly investigated prior to undertaking a project of waste disposal by crop irrigation.

New M.C.A. Supplement on Air Pollution Abatement

The Manufacturing Chemists'Association has published an up-to-date guide to the literature on air pollution and corrective techniques.

Titled "Chaper 12—Bibliography —Appednix 2," this supplement is the first of the series to include references obtained from the Batelle Technical Review. It lists American and foreign literature which appeared during 1952. The 20 supplement pages are in punched loose-leaf form and can be arranged with earlier references; price is 35 cents.

The original "Chapter 12—Bibliography" may be purchased for 50 cents, and a subscription for a three-year period costs $1.50. Write to the Association, 246 Woodward Bldg., Washington 5, D.C.

Worth Reaching For.

True, perfection may never be reached—*but*, it's worth reaching for just the same.

Fundamental Principles of Handling Chlorine

V—Dosage Control

by V. W. LANGWORTHY, *Research Chemist, The Chlorine Institute, Inc., New York*

THE application of chlorine, or its compounds, to water or wastes must be controlled within definite limits to insure economical and satisfactory attainment of established objectives. Chlorine is unique among water treatment chemicals, not only in its applications, but also in methods and equipment available for process regulations. Operators must be aware of the overall purposes of chlorination in order to control the processes which will achieve them.

Chlorination Objectives

Disinfection continues to be the foremost objective in chlorination of water and domestic wastes. Secondary purposes utilizing chlorine have developed, and pre-, post-, or plant chlorination may be practiced. The process has been extended from relatively simple plant effluent disinfection to include ramifications of intriguing complexity.

Disinfection

When chlorine is applied for disinfection, it would appear that measurements of bacterial destruction should be used to indicate the success of the treatment. Unfortunately, bacteriological methods are time-consuming to the extent that results become available too late to be of practical value in dosage control.

We have been forced, therefore, to accept an intermediate scheme of chemical testing which experience has shown to be adequate. Chlorine residual values have been accepted as the basis of control in the chlorination process. Bacteriological sampling has become a matter of spot checking to determine whether or not disinfection is actually being accomplished.

For purposes of disinfection, water or sewage may be chlorinated at the effluent end of the treatment process. Sufficient dosage must be maintained to establish a chlorine residual after a definite contact time. The magnitude of the chlorine residual required is determined by bacteriological sampling as noted earlier. The degree of bacterial kill required is extremely high in the case of public water supplies. The extent of disinfection required for sewage plant effluent varies, depending on local conditions.

It should be noted that of the chlorine applied, none can be depended on for disinfection until the chlorine demand has been satisfied. It is true that certain of the products formed in satisfying the chlorine demand will exert bactericidal action, but chemical analyses do not provide close enough correlation to permit dosage control on this basis. Sufficient chlorine must be added to establish a residual known previously to have been bactericidal.

Water Chlorination

In addition to accomplishing the disinfection of water supplies, chlorine is used to control nuisance bacteria, remove iron, assist in coagulation and control tastes and odors. Dosage is controlled on the basis of chlorine residuals which are shown to accomplish the desired objective.

Nuisance bacteria may produce slime, reduce sulfates, or otherwise exist to the detriment of the water treatment process. Slime forming organisms interfere with heat exchange units by insulating condenser tubes and restrict water flow through pipelines. Iron bacteria create nuisances often manifested in sulfide odors or in red water. Industrial process water must be free of both slime forming and sulfate reducing organisms, or product degradation may result.

Activated silica, used as a coagulant in water purification, may be prepared using chlorine as the activating agent. Chlorine used for this purpose is not lost for disinfection or other purposes.

As noted earlier, the passage of time has been accompanied by an understanding of chlorine reactions which have added complexity to chlorination processes. Tastes and odors were found to be less noticeable when chlorine and ammonia existed together, leading to wide use of the chloramine process. However, it has been learned that while chloramines exhibit germicidal activity, they also prevent chlorine from oxidizing taste and odor producing compounds. In an effort to provide an oxidizing potential of higher order, breakpoint chlorination became the next process to receive attention and to find successful application. Superchlorination followed by dechlorination has

W & T Photo

Fig. 1—CHLORINE residual comparator, disc type Orthotolidine is the indicator. Standards are permanent glass. Matching eyepiece is shown.

W & T Photo

Fig. 2—AMPEROMETRIC Titrator to measure chlorine. Relative concentrations of free available and combined available chlorine can be determined.

found favor in solving particularly difficult problems in the treatment of surface water supplies.

Control of chlorine dosage in the chloramine process is effected on the basis of chlorine residuals, all or part of which may consist of combined available chlorine. Breakpoint and superchlorination processes are predicated on the establishment of free available chlorine residuals; these residuals must be of sufficient magnitude to control troublesome tastes and odors or to accomplish some other purpose. Factors of contact time, pH and temperature must be considered in the utilization of chlorine for each application.

Sewage Chlorination

Among the secondary purposes in sewage chlorination are: odor control, B.O.D. reduction, aid to settling, foam control in Imhoff units, preventing filter ponding, control of sludge bulking, assist sludge thickening, and reduce loadings caused by digester supernatant liquor return.

It is not possible for one application of cholrine to assist in solving all problems incident to sewage treatment. Upsewer chlorination can contribute to odor control and reduce the B.O.D. load imposed on the treatment works. Prechlorination at the plant entrance controls odors and might make substantial improvements in solids removal by the settling units.

Chlorination of primary settling tank effluent improves trickling filter operation, while chlorine added to return activated sludge serves to control sludge bulking. The B.O.D. loading carried to primary settling tanks by digester supernatant return may be reduced by chlorination.

Chlorine applied to trickling filter and activated sludge processes must be controlled to prevent interference with plant efficiency. Caution must be exercised when prechlorination is practiced for odor control, to control chlorine dosage so that septicity is prevented, but not to accomplish disinfection. Many operators determine chlorine demand and adjust prechlorination units to remove one-half of the chlorine demand when treating to prevent septic conditions. Other operators report that chlorine residuals must be established in order to provide effective odor control.

Odors and ponding at trickling filter plants have been controlled by chlorination. Control of chlorination to satisfy fifty to seventy-five per cent of the chlorine demand will not adversely effect the biological growth on the filter stones, but will control odors. Filter ponding, when caused by organic accumulations, may be alleviated by chlorinating the filter influent to produce 2 to 10 ppm residual chlorine at the nozzles*. Residuals in the lower range may not upset filter operation, but for ponding control higher residuals should be attempted intermittently, such as once a week.

Chlorination at activated sludge plants to prevent sludge bulking is predicated on the selective control of biological life in the sludge returned to primary units. Too much chlorine would have a deleterious effect on the normal biological organisms depended on to carry out the treatment process. The procedure involves intermittent application of chlorine in a controlled dosage dependent on ppm solids in the returned sludge, the rate in mgd at which sludge is returned, and on the sludge index.

W & T Photo

Fig. 3—CHLORINE residual recorders. Hackensack Water Co. plant, New Milford, N.J.

These provide a continuous record of residuals in settling basin (left unit) and in plant effluent (right unit).

Industrial Wastes Chlorination

Programs for the abatement of stream pollution have required industry to examine ways and means of controlling and treating waste discharges to prevent fouling of surface waters. Industrial wastes which respond directly to chlorination are electroplating wastes containing cyanides and chemical manufacturing wastes containing phenols. This treatment has been widely accepted since cyanides and phenols are toxic to fish life and may cause stream degradation when discharged untreated. Chlorine together with an alkali may be used to oxidize either of these compounds, provided proper pH conditions and free available

*Manual of Practice No. 4, "Chlorination of Sewage and Industrial Wastes. Federation of Sewage and Ind. Wastes Assns. (1951).

chlorine residuals of sufficient magnitude are maintained during the available contact period. Chlorine dosages usually exceed the theoretical requirement due to the presence of additional oxidizable materials.

Where waste treatment plant effluent is conserved for reuse, such as irrigation or industrial process water, chlorine serves as a disinfecting agent to prevent disease transmission, in addition to oxidizing objectionable waste products.

Residual Testing Equipment

Various colorimetric procedures have been proposed for chlorine residual determination. Ortho-tolidine remains the reagent specified in Standard Methods for the Examination of Water and Sewage, and several types of commercial comparators are in use (Fig. 1). From the foregoing discussion it appears that any colorimetric method would be liable to interference from color or turbidity. The ortho-tolidine procedure does have its limitations and, while improvements have been made in the method, it falls short of the ideal technique.

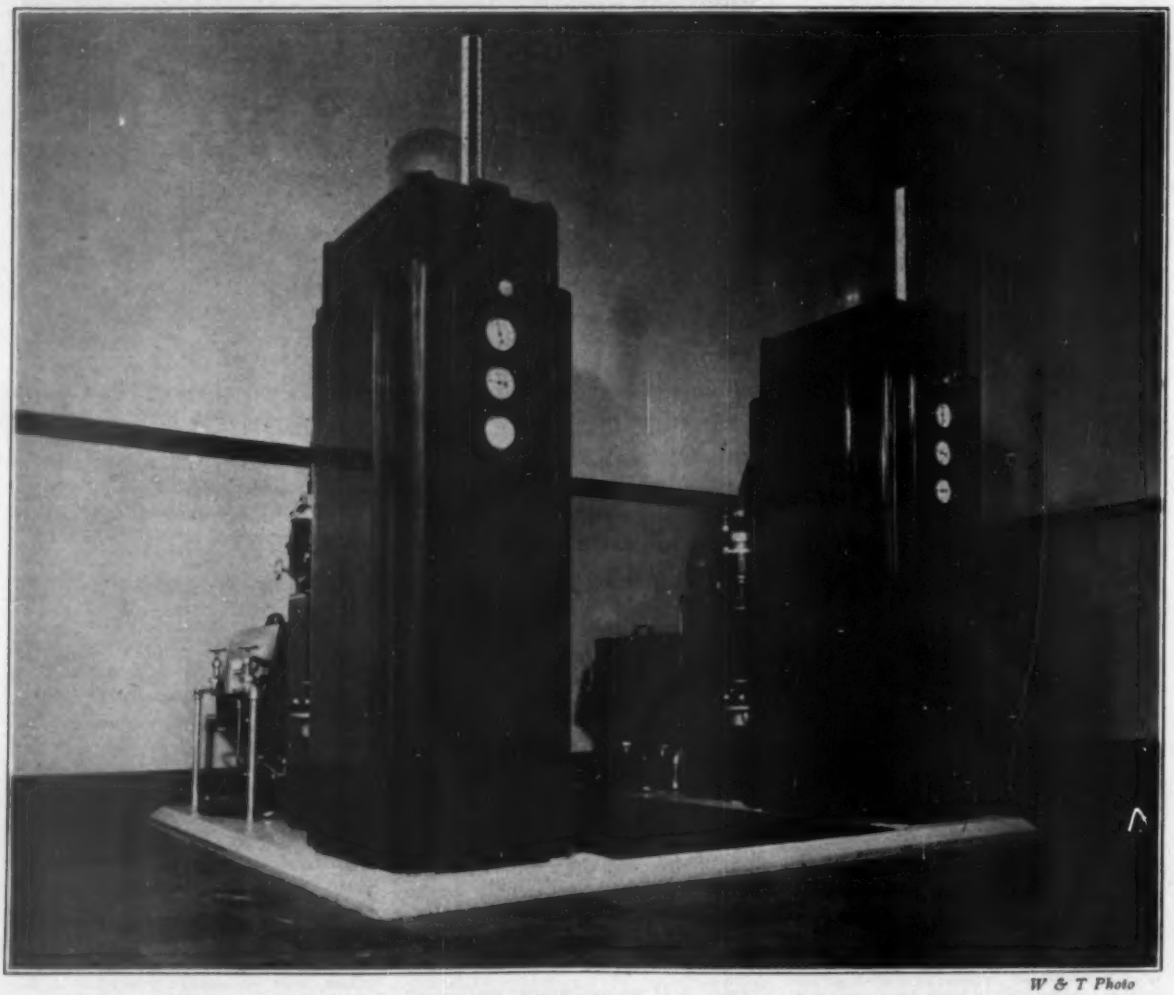
If recognition is given to the limitations of the ortho-tolidine method, it may be used to make chlorine residual determinations sufficiently accurate for most purposes. Interference due to iron, manganese and nitrites may be offset by following the ortho-tolidine-arsenite (OTA) modification. When sewage contains industrial wastes of an interfering nature, the ortho-tolidine method is a poor indicator for residual chlorine.

In water purification, the breakpoint and superchlorination processes must be controlled to provide free available chlorine residuals for minimum contact perods. The ortho-tolidine-arsenite modification permits reasonably quantitative estimation of free and combined available chlorine residuals.

The Amperometric Titrator* apparently overcomes the shortcomings of the ortho-tolidine colorimetric method (Fig. 2). This instrument measures the low flow of electric current which is produced when a sample containing chlorine is titrated with an oxidizing agent. Residual chlorine may be determined quantitatively, and it is possible to differentiate between free available and combined available residual chlorine by pH adjustment of the sample. The writer's experience indicates that the amperometric titrator measures more of the germicidal combined chlorine than is possible using the standard ortho-tolidine colorimetric procedure.

The Residual Recorder* represents a significant advancement in the field of sanitation (Fig. 3). This in-

*Products of Wallace & Tiernan Co., Inc.

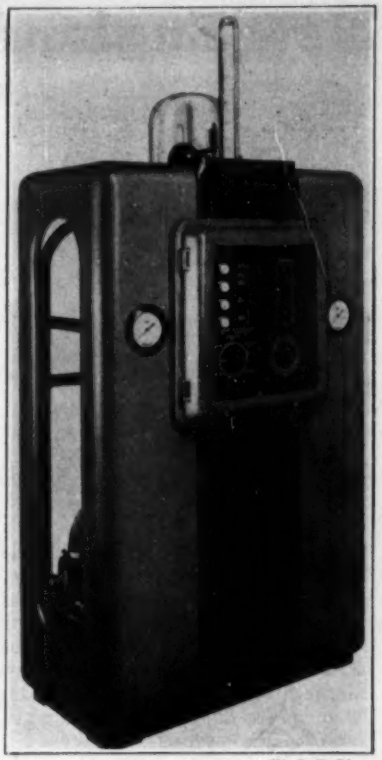


W & T Photo

Fig. 4—AUTOMATIC CHLORINATORS. A modern installation for water treatment, Town of New Toronto, Ontario, Canada. Converter units (at rear of chlorinators) adjust chlorine dosage in proportion to water flow variations.

Builders-Providence Photo

Fig. 5—AUTOMATIC CHLORINIZER and Chronoflo Transmitter, Red Bank, New Jersey. Rate of flow indicated by Transmitter and proportional dosage rate maintained by Chlorinizer.



W & T Photo

Fig. 6—PROGRAM CHLORINATOR, push button type. Other units use cam operated control.

strument provides a continuous indication of chlorine residuals and provides a permanent record of daily results. Interruptions in chlorine application and variations in chlorine demand can be announced by alarms which are available as accessories with the apparatus. Further refinements may eventually include provisions for automatically varying the application rate.

Proportional Flow Control

Trends toward instrumentation and automatic operation in industry have been evidenced in the field of sanitation. Chlorine dispensing equipment has been developed which will respond to variations in flow of the medium being chlorinated (Figs. 4 and 5). This is an important feature, one which greatly increases the efficiency of treatment and simplifies the responsibilities of operating personnel.

The operation of automatic proportioning equipment depends on pressure differentials produced when a liquid flows through a Venturi tube, orifice plate, Kennison nozzle, or Parshall flume. The differentials resulting from flow changes are transmitted to converting units which cause the chlorine dispenser to alter its dosage at a corresponding rate.

Changes in chlorine demand cannot be interpreted by automatic proportioning installations, consequently the operator must make manual adjustments to insure adequate feed of chlorine. The equipment will pace the chlorine dosage automatically proportional to liquid flow for any manual setting.

Program Control

The term "program control" is used to denote intermittent chlorine dosage according to a pre-determined schedule. Such applications include chlorination of cooling water lines for slime control and installations where pumps operate on a pre-set schedule, etc. Equipment has been developed which will permit chlorine application on an intermittent basis over a twenty-four hour period.

In program control chlorination, advance information is required so that appropriate time settings may be made to schedule chlorine dosage at a pre-selected rate over the time interval desired. Program controllers are available which operate either on a cam rotation or push button principle (Fig. 6).

Summary

Dosage control must be recognized as the foundation upon which a successful program of chlorination is built. Proper dosages for disinfection greatly exceed amounts necessary for odor control at sewage works. The amount of chlorine required to disinfect a water supply on one day (or even one hour) might fall far short of adequacy or constitute overchlorination on the following day (or hour), even though the volumes of water treated are equal.

Determinations of residual chlorine indicate whether or not sufficient chlorine has been added to establish desired conditions. Operating personnel must realize the limitations of chlorine residual test methods and, where possible, relate chlorine dosage directly to results accomplished.

Automatic devices have made substantial contributions to facilitate dosage control, but plant operators must make manual adjustments for variations in chlorine demand.

Acknowledgement

The author appreciates the assistance of equipment manufacturers in providing illustrations and valuable technical advice in the preparation of these articles.

New England Sew. & Ind. Wastes Assn.*

Holds 24th Annual Meeting in East Providence, R.I.

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Woonsocket, R. I.
(Incoming)

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Conn.
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Providence, R.I.

Director

Henry Campbell
Prof. Civ. Engr.
R. I. State Coll.
Kingston, R. I.
(Prog. Chair.)

NOVEMBER 5, 1953, was the date; Wannamoisett Country Club, in East Providence, R.I., was the place; and technical papers and plant visitations were the features of the 24th annual meeting of the New England Sewage & Industrial Wastes Assn. More than 200 persons registered for the meeting.

Business Meeting

New officers elected for the ensuing year included:

President

Charles G. Hammann, Commissioner
Public Works Department
Woonsocket, R.I.

1st Vice President

Walter E. Merrill, Pub. Health Engr.
Mass. Dept. of Health
Boston, Mass.

2nd Vice President

J. Henry L. Giles, City Engineer
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Henry Campbell, Prof.
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Rhode Island State College
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Metropolitan District
Hartford, Conn.

Walter A. Lawrence, Prof.
Civil Engineering School
Bates College
Lewiston, Me.

Secretary-Treasurer

Stephen M. Hurley, San. Engr.
R.I. State Dept. of Health
Providence, R.I.

Announcement was made at the business session of the success of the *NESIWA News Letter*, which was inaugurated at the spring, 1953, meeting, with Henry Munroe of Providence as editor. The second issue was available at this meeting and contained the first "Save Sheet," a copy of which is shown in an accompanying illustration in this report.

Announcements were also made of plans for the 25th Silver Anniversary meeting at the Hotel Somerset in Boston on April 23 and 24, and of the present membership count of 380.

The Ladies Program of this meeting included a bus trip to Wickford, R.I., for a lunch, followed by a conducted tour and demonstration at the College of Home Economics, University of Rhode Island, Kingston, R.I.

Technical Sessions

Following the business session concurrent technical sessions were held on Sewage Treatment and Industrial Wastes.

Sewer Jointing

"MODERN MATERIALS AND METHODS FOR SEWER JOINTING" was the title of a paper presented by Raymond B. Seymour, Exec. Vice Pres., Atlas Mineral Products Co., Mertztown, Pa.

Mr. Seymour pointed out that a wide variety of materials has been proposed for sewer lines, but since it is impractical to make a jointless line, the effectiveness of a sewer system is dependent on the joints. Pipe joint specifications to produce a "perfect" pipe joint should include the following: (1) Simplified directions for use; (2) Foolproof and rapid installation procedures to permit early use of the line; (3) Freedom from toxic or soluble components, porosity or other imperfections; (4) Permanent bond to the pipe under all normal service condition; (5) High resistance to infiltration and ex-filtration; (6) Complete resistance to normal household wastes, cleaners, detergents, greases, and normal soil conditions; (7) Sufficient flexibility to permit normal movement of a pipeline resulting from settling; (8) Sufficient strength to resist breaking of the joint in the trench; (9) Long life with original properties and resistance to both slumping and cracking; (10) Resistance to root penetration.

*Reported by George E. Symons, Ph.D., Consultant & Technical Editor.

Luncheon and Inspection Trip

Head Table

E. Providence Plant

M.I.T. San. Engr. Graduate Students

Ray B. Seymour
Exec. V. Pres.
Atlas Min. Prod.
Mertztown, Pa.

Clair Sawyer
Prof. San. Engrs.
M. I. T.
Cambridge, Mass.

Programmers:

I. W. Van Kleeck
Prin. San. Engr.
St. H'lth Dept.
Hartford, Conn.

E. W. Ward
Partner
Haley & Ward
Boston, Mass.

W. H. Oldaker
San. Engr.
Lawrence Expt. Sta.
Lawrence, Mass.

C. V. Hickey
Operating Engr.
Bucklin Pt. Plant
E. Providence, R. I.

Mr. Seymour then discussed the history, characteristics, advantages and disadvantages of twelve types of joints and jointing materials. These included: Hot-poured filled asphalt joints, filled plasticized sulfur compositions, filled coal tar pitch joints, hot-poured filled plastic joints, precast asphaltic joints, neat cement joints, ready-mixed trowelable compositions, on-the-job mixed trowelling compositions, chemical resistant joints, tubular joints, vinyl plastisol joint, and straight end pipe.

In conclusion, Mr. Seymour stated that for domestic sewage in locations where root resistance is not important, vitrified clay pipe joined by hot-poured filled asphalt joints should be used; where root resistance is essential, a hot-poured filled plastic joint should be used. Either joint will suffice for cold industrial wastes in the absence of water immiscible solvents but a combination joint consisting of an infusible furane and a plasticized sulfur cement is recommended whenever solvents or warm industrial wastes are present.

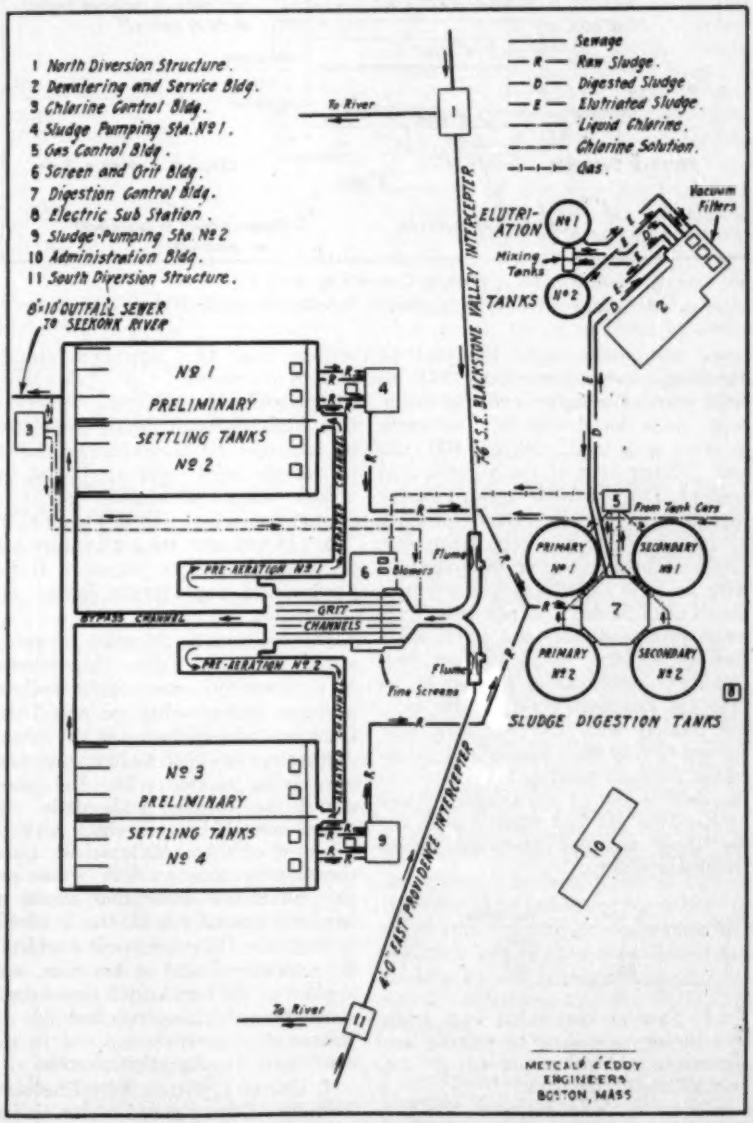
Digester Liming

"A Scientific Basis for the Liming of Digesters" by Clair N. Sawyer, Prof. of Sanitary Chemistry, Massachusetts Institute of Technicology, presented some new information on an old controversy.

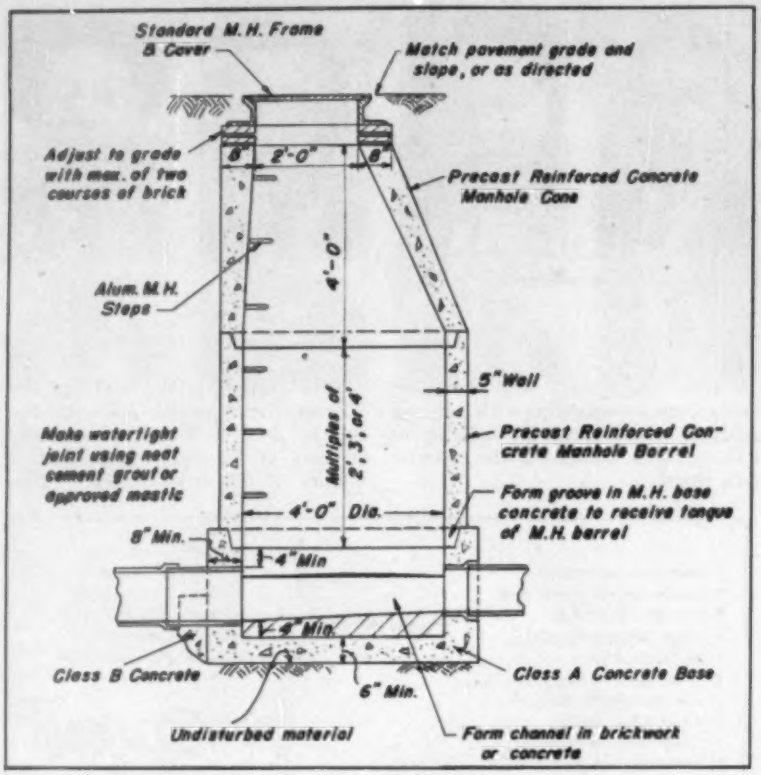
As a prelude to the discussion Dr. Sawyer explained how there are two general types of organisms operating in a sludge digester; the saprophytic bacteria which break break down the complex organic compounds to simple substances and the methane bacteria which convert these simple substances to methane and carbon dioxide. These two work fine together as long as the concentration of volatile acids in relatively low.

The amount of acids which can be tolerated depends on the buffer capacity of the digester contents and this buffer capacity is largely the alkalinity produced by the reaction of calcium, magnesium and ammonia from soaps and proteins with carbonic acids produced from the solution of CO_2 which is formed in the gasification reaction.

Prof. Sawyer pointed out that lime will react with volatile acids and thus can be used to increase the buffer capacity of the sludge. At M. I. T. studies of this reaction were under-



Bucklin Point Sewage Treatment Plant, E. Providence, R.I.
(Blackstone Valley Sew. Distr. Comm.)


Standard M.H. Frame & Cover
Match pavement grade and slope, or as directed
Adjust to grade with max. of two courses of brick
8"
2'-0"
8"
Precast Reinforced Concrete Manhole Cone
4'-0"
Alum. M.H. Steps
5" Wall
Make watertight joint using neat cement grout or approved mastic
Multiples of 2', 3', or 4'
Precast Reinforced Concrete Manhole Barrel
Form groove in M.H. base concrete to receive tongue of M.H. barrel
4'-0" Dia.
8" Min.
4" Min
4" Min.
Class B Concrete
Class A Concrete Base
6" Min.
Undisturbed material
Form channel in brickwork or concrete

Precast Concrete Manhole
Furnished by E. B. Cobb of Metcalf & Eddy for *NESIWA News Letter.*

taken two years ago. Samples of digesting sludge containing 4000 to 5000 ppm of volatile acids (as acetic acid) were dosed with lime sufficient to react with 0, 25, 50, 75, 100, 150 and 200 per cent of the volatile acid content. The pH of the treated sludge ranged from 4.9 (for zero treatment) to 10.3 for 200 per cent treatment. Gasification showed varying patterns; with no lime added gas was not produced until 55 days, 50 per cent treatment produced alternate gasification and no activity. With 150 per cent treatment, gasification started in 10 days and remained good, but the sample treated with 200 per cent lime started in less than 5 days and gasification not only remained high but was the best of any of the sample. After 55 days the pH and volatile acids for the three samples receiving lowest treatment was:

No.	% Lime	Vol. Acids	pH
1	0	4040	5.70
2	50	3540	6.40
3	75	220	7.3

Prof. Sawyer concluded that scientific liming according to volatile acid content would either prevent or correct a "stuck" digester.

LeRoy W. Van Kleeck, Sanitary Engr., Conn. State Health Dept., Hartford, Conn., discussed the paper stating that Dr. Sawyer's studies should remove the "doubting Thomases". He point out, however, that indiscriminate liming could not be tolerated. It is preferable not to let volatile acids build up, but if the volatile acids test is used, it can be a good control of digester operation. The pH test and total alkalinity can be used for control purposes, if the sludge and supernatant liquor are thoroughly mixed.

Dr. George E. Symons, Consultant & Technical Editor, Larchmont, N.Y., described some unpublished experience he had when he was Chief Chemist of the Buffalo (N.Y.) Sewer Authority in 1938 when digesters were being started cold. He determined the volatile acids daily and added enough lime to react with 50 per cent of the volatile acids. Lime consumption reached 5 to 6 tons per day which was more than could be handled manually with the available work force. The treatment could not be maintained and when heat was applied to the overloaded tanks some weeks later, foaming resulted, but the treatment apparently did aid in the control of the digestion process.

J. Henry L. Giles, City Engineer, Meriden, Conn., asked about liming unheated digesters and whether other alkalies could be used. Dr. Sawyer replied that unheated digesters could be limed but liming would not take the place of heat in affecting the rate of gas production. As to other alkalies, Prof. Sawyer said they could be used but that he had not had any success in adding calcium carbonate (finely ground limestone). Ammonia gas has been used.

Tannery Wastes

"Treatment of Wastes at Hartnett Tannery" was described by E. Warren Ward, Partner, Haley & Ward, Cons. Engr., Boston, Mass.

The solution of the problem at Ayer, Mass., where tannery wastes were discharged to a pond was sought through cooperative effort by the village and the Hartnett Tannery Co. The lime and tanning wastes which entered the pond caused odors and were affecting the ground water supplies.

The first approach was to consider primary treatment for the plant wastes alone, but it appeared that this solution would not be satisfactory. It was finally decided to take the wastes into the town plant, to build a plant large enough to handle both domestic and industrial wastes and to finance the project jointly. The wastes could not be taken into the town sewers, so the company built a force main and pump station.

The plant consists of Imhoff tanks, trickling filters, final clarifiers and digestion tanks for 5000 persons, and separate settling tanks for the tannery wastes. These tanks provide 2 hr. detention and sludge settled from the wastes goes directly to drying beds, liquid overflow from the tanks is mixed with the effluent from the Imhoff tanks and goes to the trickling filters. The average waste flow is 1 mgd with day-time rates of 2 mgd. Excess flow above trickling filter capacity goes to a holding tank until flow rates drop.

The tannery sludge dries well, shrinks to about one-half volume in a short time, but the amount of it, 50 tons a day, presents a problem of removal and disposal. Disposal at present is to a swamp as fill.

The town is to be paid back for its expenditures by way of an annual charge to the tannery, and the cost of operation of the sewage works is to be prorated between industry and municipality on the basis of actual cost of use.

Industrial Wastes

Two other papers on industrial wastes were presented: "Treatment of Wool-Scouring Wastes", by Richard E. Briggs, Manager Talbot Wool Combing Co., Norton, Mass., and

"Treatment of Flax Cooking Wastes", by Warren H. Oldaker, Lawrence Experiment Station, Lawrence, Mass. Unfortunately it was impossible to report both sessions at the same time and these two papers could not be covered.

Inspection Trips

During the afternoon concurrent inspection trips were held, one to the Blackstone Valley Sewer District Commission and the other to the East Providence Plant.

Prior to the trips, the "Bucklin Point Sewage Treatment Plant Description and Operation", were presented by Clarence V. Hickey, Operating Engineer. A flow diagram of the plant is shown herewith. Some pertinent data on the plant are given in the following tabulation:

	1953 Condition	1975 Design
Population Served	46,460	158,600
Flow mgd	20.8	47.2
" Sewage mgd	7.0	17.8
" Ind. Waste	13.12	27.4
Susp. Solids—ppm	106	106
lb/cap/day	0.382	0.264
B.O.D.—ppm	196	160
lb/cap/day	0.71	0.398

Also prior to the trips, the "East Providence Sewage Treatment Plant" was described by John O'Sullivan, San. Engr. This plant was due to start operations the following week. It is an 8 mgd plant consisting of Parshall flume, communitors, grit chambers, primary tanks, four circular trickling filters, chlorination before and after filters (there are many residences next to the plant site), sludge digestion (floating covers and PFT Heat Exchangers), and sludge dewatering (on a Komline-Sanderson Coil Filter).

Walt. C. Anderson
Supt.
Sew. Treat. Wks.
Cranston, R. I.

W. H. Brown, Jr.
Proj. Engr.
Builders-Prov.
Providence, R. I.

Local Arrangements

How. Carpenter
Supt.
Sew. Treat. Wks.
Providence, R. I.

Henry Munroe
Chem. Engr.
Proportioneers, Inc.
Providence, R. I.

Award Presentation

At the luncheon for which there was room for only 165 of the 205 registrants, the Mayor of East Providence paid tribute to water and sewage works people and cited a local instance wherein the Editor of the *NESIWA News Letter*, Henry Munroe, has rendered service to the city.

E. Sherman Chase, Partner, Metcalf and Eddy, Cons. Engrs., Boston, and immediate past president of the Federation of Sew. & Ind. Wastes Assns., presented the Kenneth Allen award of the Federation to Walter E. Merrill, long time secretary of the New England Sew. & Ind. Wastes Assn. Mr. Merrill had been unable to be in Miami to receive the award.

NESIWA President Bond expressed the sentiment of the association to Mr. Chase in remarking that everyone in New England was proud of the service that Mr. Chase had rendered the Federation as its president.

Dr. Imhoff, Recipient of Numerous Honors, Decorated by German Republic

Case of "Honor to Whom Honor is Due."

In special recognition of his services to mankind in the field of sanitation and public health the president of the German Federal Republic has awarded Dr. Karl Imhoff of Essen, the Great Cross of the Republic for distinguished services in the field of sanitary engineering.

The "Great Cross" is the highest decoration of merit awarded by the German Government to engineers and scientists who have rendered non-political, humanitarian services in science and engineering. The presentation of the award was made the occasion of a special joint meeting of German sanitary engineers and federal officials.

As is well known, Dr. Imhoff's life has been devoted to sanitary engineering in the heavily populated industrial districts of Germany. He was early to recognize the importance of planning the economy of natural water resources in his district. In 1906 he took over the direction of the Ems Cooperative Sanitary District and subsequently became its engineering director. In 1913 the famed Ruhrverband was founded and Dr. Imhoff at first directed its affairs as an additional task. Then in 1922 he became its official director. Incidentally he made his experience useful in numerous other fields of water economy and public hygiene.

The engineering world is familiar with the researches and inventions of Dr. Imhoff in sanitary engineering and how they have influenced all civilized countries. His famous "Taschenbuch der Stadtentwaesserung" was translated into principal languages and rapidly became the chief tool of professional sanitary engineers of all nations.

The Institutes of Technology in Karlsruhr, Dachen and Stuttgart individually bestowed on the Doctor honorary degrees. In October Dr. Imhoff was also honored in this country by being voted Honorary Membership in the Federation of Sewage & Industrial Wastes Associations.

The chief characteristic of this renowned 77-year-old originator of the well known Imhoff Tank is that of humility. Undoubtedly his chief reward comes from the realization that his life's labors have contributed materially to the advancement of community sanitation and the welfare of mankind.

> "Those who would take over the world and shape it to their will, never, I notice, succeed."—*Lao Tzu.*

THE EDITOR'S COMMENTS

Engineering Economics in Sewage Treatment Practice

Faced with the necessity of providing treatment of its sewage, at a material expense of providing high degree treatment, the Town of Salem, Va., was well advised, after a careful study of comparative costs by its consulting engineer, W. Martin Johnson of Lynchburg, Va., to explore the possibility of contracting with its neighbor city of Roanoke for treatment of Salem's sewage in the latter's ample capacity and practically new activated-sludge type treatment plant.

With equally realistic reasoning Roanoke's consulting engineer, Louis R. Howson of Chicago, advocated such a contract on terms fair to all concerned. The result is a fifteen year contract between the two cities, with charges for treatment put on an adjustable schedule, based on operating costs for treatment plus a reasonable additional charge to cover interest on plant investment and depreciation. It does not take much imagination to see the economic advantage to both cities which results from such an arrangement.

This scheme to our thinking is more clean cut and, thereby, offers advantages over a joint plant ownership and operation in any form. The city of Roanoke is merely offering a utility service to the Town of Salem, not unlike the operation of a publicly owned water utility which sells metered water to an adjoining community at cost-plus rates.

The Town of Salem runs little if any risk in the deal, since it can void the contract by giving a three year notice to Roanoke at any time after the first five year period of the arrangement. To our thinking the contract has been so fairly drawn that Salem will never find it economically advantageous to withdraw from the arrangement—nor will Roanoke, whose net cost for sewage treatment will be reduced thereby.

For the benefit of those interested, the terms of the contract are briefly the following:

(1) During the first five year period of the agreement Salem contracts to pay Roanoke $30.00 per million gallons of sewage treated.

(2) For the years which follow, the charge agreed to will be that of actual maintenance and operating costs per million gallons, based on experience during the year preceding, but with an added charge of 20 per cent to cover interest on investment, depreciation, and what might be designated a reasonable service charge.

(3) Salem is protected against possible excessive costs of treatment and maintenance in future years by an escape clause. This clause permits a three year notice of termination of contract by Salem if and when the overall total charges mount to $60.00 or more per million gallons treated.

The details of the contract and points of disagreement were ironed out by a committee made up of two representatives of each city, aided and guided by counsel and consulting engineers for both cities.

According to estimates of the consulting engineers Salem has avoided an immediate expenditure of $580,000 for sewage treatment facilities, after deducting the cost of the trunk sewer to convey sewage to the Roanoke system. In addition Salem stands to save not less than $28,000 annually by having its sewage treated in the Roanoke plant, not to mention the saving of headaches for Salem's city manager and superintendent of water and sewage.

To our thinking the method employed in solving Salem's sewage treatment problem is one that should be studied closely and adopted in principle as widely as circumstances permit.

Short School Expenses Deductible from Income Tax

Some of our readers will find of interest the outcome of a case before the U.S. Tax Court, in which a taxpayer claimed that expenses he had incurred in taking what amounts to a "short course," as we know these "schools" or conferences in the water and sewage field, was deductible for income tax purposes.

In the case at point the taxpayer had attended an in-service training school in the field of finance. His expenses incurred amounted to $305.00, which he entered on his tax return as a deductible business expense. Since the tax law does not allow the expense of attending college, trade schools or that of learning a profession as deductible expenses, the "short-school" expense was disallowed by the Collector of Revenue.

Appeal by the taxpayer to the U.S. Tax Court resulted in a split decision on the case. This permitted appeal to the Second Circuit Court of Appeals which has, correctly to our thinking, rendered a decision in favor of the taxpayer.

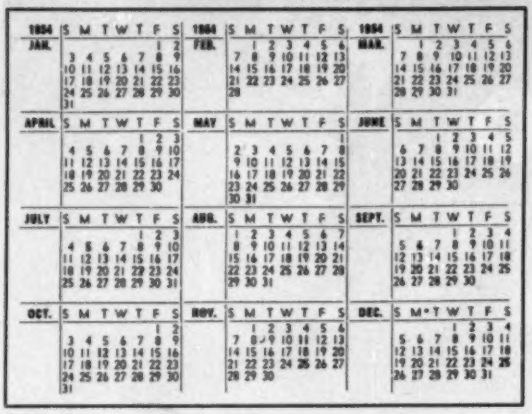
The reasoning of the court was as follows: The government recognizes for income tax deductions such expenses as dues in professional societies, subscriptions to technical and professional magazines, cost of technical books, subscriptions to financial advisory services, and the like. Consequently, an expense of attending "short-schools" or the taking of refresher courses is no different on the whole from expenses incurred in memberships in professional societies, or purchase of technical books and magazines. All of these things fit into the technical and professional man's moral duty to keep abreast of his subject and alive to current developments in the field in which he earns income subject to taxation.

We daresay that few if any of those in our field have ever considered taking advantage of the now permissive deduction from income of expense incurred in attending short-schools, taking correspondence courses or attending conferences. We hope that all have taken advantage of the permissive deduction of professional society and association dues, the cost of technical magazines, books, instruments, and the like. We now urge the addition of all expense incurred in attending "short-schools," taking of correspondence courses and similar undertakings and activities looking toward keeping abreast of technical developments.

We believe that the same case can be made out for the deduction of expense incurred in attending the so-called conventions of the technical associations serving the water, sewage and industrial waste fields. Actually these amount to technical conferences rather than conventions.

Lyle Enslow

Meetings Scheduled



Jan. 19, 1954—New York, N.Y. *(Hotel Commodore)*
NEW YORK SECTION A.W.W.A. (Winter Luncheon Meeting). Sec'y, Kimball Blanchard, 50 West 50th Street, New York, N.Y.

Jan. 21-22—New York, N.Y. *(Hotel Belmont Plaza)*
NEW YORK SEWAGE & INDUSTRIAL WASTES ASSOCIATION, Sec'y, R. C. Sweeney, 21 No. Broadway, White Plains, N.Y.

Jan. 21—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. (Monthly Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Feb. 9-10—Portland, Me.
MAINE WATER UTILITIES ASSOCIATION. (Annual Meeting). Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Feb. 10-12—Indianapolis, Ind. *(Lincoln Hotel)*
INDIANA SECTION A.W.W.A. Sec'y, Geo. G. Fassnacht, 1330 W. Michigan St., Indianapolis 7, Ind.

Feb. 11-12—Columbus, Ohio *(Ohio State Univ. Campus)*
OHIO WATER CLINIC CONFERENCE. (3rd Annual Meeting). Director, Kenneth W. Cosens, Ohio State Univ., Columbus, O.

Feb. 15-19—Atlanta, Ga. *(Hotel Biltmore)*
AMERICAN SOCIETY CIVIL ENGINEERS. (Winter Meeting). Exec.-Sec'y, Wm. N. Carey, 33 W. 39th St., New York, N.Y.

Feb. 16—Newark, N.J. *(Essex House)*
NEW JERSEY SECTION A.W.W.A. (Winter Meeeting). Sec'y, C. B. Tygert, P.O. Box 178, Newark, N.J.

Feb. 18—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. (Monthly Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Feb. 25-27—San Francisco, Calif. *(Fairmont Hotel)*
AMERICAN CONCRETE PIPE ASSOCIATION. Director, Howard F. Peckworth, 228 No. LaSalle Street, Chicago, Ill.

Mar. 10-12—Atlantic City, N.J. *(Traymore Hotel)*
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Michael S. Kachorsky, P.O. Box 766, Manville, N.J.

Mar. 10-12—Baton Rouge, La. *(Louisiana State Univ.)*
WATER & SEWERAGE SHORT COURSE. Director, John H. O'Neill, Dept. of Health, New Orleans, La.

Mar. 17-19—Chicago, Ill. *(LaSalle Hotel)*
ILLINOIS SECTION A.W.W.A. Sec'y, Dewey W. Johnson, 122 So. Michigan Ave., Chicago, Ill.

Mar. 18—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND SECTION A.W.W.A. Sec'y, Geo. G. Bogren, 14 Beacon St., Boston 8, Mass.

Mar. 18—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. (Monthly Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Mar. 18-19—Raleigh, N.C. *(North Carolina State College)*
THIRD SOUTHERN MUNICIPAL & INDUSTRIAL WASTE CONFERENCE. Conference Chairman, Dr. Nelson L. Nemerow, Dept. of Sanitary Engineering, N. C. State College, Raleigh, N.C.

Mar. 22-24—Little Rock, Ark. *(Marion Hotel)*
ARKANSAS WATER & SEWAGE CONFERENCE. Sec'y, Dr. Harrison Hale, Southern State College, Magnolia, Ark.

Mar. 22-26—Amherst, Mass. *(New England Field Training Center)*
SEWAGE TREATMENT WORKS OPERATORS SHORT COURSE. Director, A. A. Robertson, State Dept. of Health, Boston, Mass.

Mar. 29-31—Greenville, S.C. *(Poinsett Hotel)*
SOUTHEASTERN SECTION A.W.W.A. (25th Annual Meeting). Sec'y, N. M. deJarnette, 245 State Office Bldg., Atlanta 3, Ga.

Apr. 7-9—Emporia, Kan. *(Broadview Hotel)*
KANSAS SEWAGE WORKS ASSOCIATION. Sec'y, Dwight F. Metzler, State Board of Health, Marvin Hall, Room 2, Univ. of Kansas, Lawrence, Kan.

Apr. 7-9—Emporia, Kan. *(Broadview Hotel)*
KANSAS SECTION A.W.W.A. Sec'y, Harry W. Badley, 119 West Cloud, Salina, Kan.

Apr. 12-14—Toronto, Ont. *(Royal York Hotel)*
CANADIAN SECTION A.W.W.A. Sec'y, A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

Apr. 14—Norway, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Apr. 22-23—Watertown, N.Y. *(Woodruff Hotel)*
NEW YORK SECTION A.W.W.A. (Annual Spring Meeting. Registration evening of 21st). Sec'y, Kimball Blanchard, 50 West 50th Street, New York, N.Y.

Apr. 22-23—Lincoln, Neb. *(Cornhusker Hotel)*
NEBRASKA SECTION A.W.W.A. Sec'y, E. Bruce Meier, University of Nebraska, Lincoln, Neb.

Apr. 22-24—Tucson, Ariz. *(Santa Rita Hotel)*
ARIZONA SECTION A.W.W.A. Sec'y, M. V. Ellis, Supervisor Sewage Treatment Plant, Phoenix, Ariz.

Apr. 23-24—Bozeman, Mont. *(Baxter Hotel)*
MONTANA SECTION A.W.W.A. Sec'y, A. W. Clarkson, State Board of Health, Helena, Mont.

Mav 5-8—Sacramento, Calif. *(Hotel Senator)*
CALIFORNIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sam A. Weed, Room 315, City Hall, Oakland, Calif.

May 10-12—Lafayette, Ind. (Purdue University)
NINTH PURDUE INDUSTRIAL WASTE CONFERENCE. Director, Prof. Don E. Bloodgood, Purdue University, Lafayette, Ind.

May 23-28—Seattle, Wash. *(Exhibits and Technical Sessions—Auditorium)*
AMERICAN WATER WORKS ASSOCIATION. (74th Annual Convention). Exec.-Sec'y, Harry E. Jordan, 521 Fifth Ave., New York 17, N.Y.
(All reservations will only be cleared through A.W.W.A. office).

June 9—Lisbon Falls, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

June 14-19—Atlantic City, N.J. *(Chalfonte Haddon Hall)*
AMERICAN SOCIETY CIVIL ENGINEERS. Exec.-Sec'y, Wm. N. Carey, 33 West 39th St., New York, N.Y.

June 16-18—Allentown, Pa.
PENNSYLVANIA SECTION A.W.W.A. Sec'y, L. S. Morgan, State Dept. of Health, Greensburg, Pa.

June 22—Boonton, N.J. *(The Knolls Golf Club)*
NEW JERSEY SECTION A.W.W.A. (Summer Outing). Sec'y, C. B. Tygert, Box 178, Newark, N.J.

Aug. 11—Bingham, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Sept. 9-10—Montauk, N.Y.
NEW YORK SECTION A.W.W.A. (Annual Fall Meeting). Sec'y, Kimball Blanchard, 50 West 50th Street, New York, N.Y.

Oct. 4-6—Poland Spring, Me. *(Poland Spring House)*
NEW ENGLAND WATER WORKS ASSOCIATION. (73rd Annual Convention). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Oct. 13—Brunswick, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

How Many Do YOU Read?*

A well known engineer, now dead, whom I once knew and admired had this to say about engineers and their reading habits in respect to technical journals and magazines.

He said—"Every engineer who amounts to anything subscribes to at least one engineering journal. The engineer who runs a hoist takes a journal that pertains to hoists. The engineer who operates the power plant in a hotel takes the power journal of his association. The engineer who operates a larger plant, such as a municipal water or power plant, may take two or three journals. A consulting engineer will take as many as ten technical magazines and journals. As an engineer's position in science and industry advances he usually takes more journals."

* Contributed by W. F. Schaphorst, M.E., Newark, N.J.

BIGGEST cast iron pipe man at the dinner

R. D. Wood Co. 150th Anniversary Dinner Has Iron Man Guest of Honor

A half-ton cast iron man was guest of honor recently at the 150th anniversary dinner of R. D. Wood Co., Philadelphia, pioneer manufacturer of cast iron pipe. The figure, life size in height and of powerful build, was assembled in the Barclay Hotel, Philadelphia, from pipe and fittings brought from the firm's Florence, N. J., plant. In a shining black painted

Flexible SALES CORPORATION

3786 DURANGO AVE., LOS ANGELES 34, CALIF.
(DISTRIBUTORS IN PRINCIPAL CITIES)

The City of Chicago recently required 14 special type bucket machines with "height extensions", allowing the load to be emptied directly into the dump truck. "Flexibles" was its choice. Pictured above are these "made-to-order" machines just prior to leaving the Flexible plant in Lima, Ohio. We have, or can "tailor", equipment required to meet your city's special needs. Write for FREE CATALOG.

AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS AND EQUIPMENT

suit, the "cast iron man who came to dinner" stood at the dining room entrance with right arm extended and with a happy smile to greet fifty other guests, officials of the nation's leading cast iron pipe manufacturing concerns.

A history of the company in book form has been published in observance of the anniversary. It notes that R. D. Wood Co., was supplying the City of Philadelphia with water pipe in 1816. Pipe dating back to 1822, and still in use, has been noted under Philadelphia streets during recent excavations.

The first cast iron pipe produced in the United States was made in Millville, N. J., where R. D. Wood Co., started in 1803. Products of a few ounces to 40,000 pounds in weight are supplied today by the firm. Fire hydrants and more than seventy-five miles of underground pipe were supplied by the company for installation at Levittown, Pennsylvania.

Farther from home, the company has supplied cast iron pipe to Karachi, capital of Pakistan; Odessa on the Black Sea; Java; South Africa; and to Iceland, where pipes must withstand high pressure steam and boiling water coming up from volcanic fissures.

Fifth Report by the Ohio River Valley Sanitation Comm.

Cleaner streams in the Ohio River valley are becoming a reality. This is the conclusion to be drawn from the 5th annual report of the Ohio River Valley Water Sanitation Commission. The report clearly summarizes the action program of the states, municipalities, industries, and Commission.

The record for municipalities in the Ohio valley shows that 43 percent of the sewered population of 9,320,000 is now receiving some form of treatment. During the past year, 74 sewage treatment plants or additions to serve almost 800,000 people were either placed in operation or under construction. Equally impressive is the status of industrial-waste installations, which shows that two-thirds of the industries discharging directly into streams of the basin are now operating control facilities.

"Five years is a short time in a campaign of interstate pollution control when we consider the problem has been more than fifty years in the making," said Edward J. Cleary, executive director of the Commission, in the report presented to the governors. "But in this brief period during which the eight states have pooled

(*Continued on page* 100A)

Air-handling specialists for 100 years

Starting in 1854 with the invention of the Rotary Positive Blower by our founder, Francis M. Roots, our company's services to industry were, for many years, devoted exclusively to air-handling problems.

As industry developed new applications of gases for fuels and chemicals, it was a natural step for us to move into this field because the general principles of moving and measuring air and gas are so closely similar.

Thus, Roots-Connersville service has been widened to include seven basic types of equipment . . . all devoted to the handling of either gas or air. The most recent development has been the new, amazingly efficient Spiraxial Compressor, first marketed in 1953.

So, for a century we have been engaged exclusively as specialists in handling gas and air. That is our only business. We like to think that this is one of the important reasons why R-C equipment has been so widely accepted in every industry where processing involves the movement of air or gas.

The growth which we have experienced over 100 years could not have been possible without the loyal support of our many thousands of customers. We thank them for this evidence of good will—and we offer the same high type of equipment and service to any industry that has a problem of moving gas or air.

Reg. U.S. Pat. Off.

ROOTS-CONNERSVILLE BLOWER

BLOWER BUILDERS SINCE 1854

A DIVISION OF DRESSER INDUSTRIES, INC.
154 Mount Ave. • Connersville, Indiana

Centrifugal and Rotary Positive Blowers and Exhausters • Positive Displacement Meters • Vacuum Pumps • Gas Pumps • Inert Gas Generators • Spiraxial Compressors

Making tight, dependable joint on Jeffersonville job with Ropax and Kalktite.

TO GET TIGHTER SEWER JOINTS

Jeffersonville, Ind., Specified

"ROPAX® packing and cold applied **KALKTITE®** sewer joint compound

To reduce ground water infiltration to a minimum and protect against overloading the sewage disposal plant, Jeffersonville, Ind., needed positively tight, dependable sewer joints in their new 25-mile sewer project.

That is why they chose Ropax and Kalktite, recognized from coast to coast over a 30-year period for producing exceptionally fine results.

Ropax is a non-porous sewer joint packing that provides *additional* joint sealing material. It forms a solid, watertight seal when caulked back in the pipe bell and permits proper pipe alignment. Available in ¾" to 1¼" diameters, there is Ropax packing for all sizes of bell and spigot pipe.

Kalktite is a sewer joint compound that is mixed and applied *cold* on the job. It sets up even under the most adverse pipe laying conditions, forming a dense, tough and flexible seal that allows normal sewer line settlement and alignment deflection. Economical to use, Kalktite allows installation of more joints per man, per hour, per day.

***WRITE TODAY** for samples and new catalog with detailed information on getting better, tighter sewer joints with Ropax and Kalktite.*

PRESSTITE Sealing Compounds

PRESSTITE ENGINEERING COMPANY

3780 Chateau Ave., St. Louis 10, Mo.

their resources and police powers to do a job no one of them could do alone, a great transformation has occurred. New pollution has been curbed, existing pollution is being decreased and the trend of a half a century has been reversed."

Copies of the attractively designed and clearly organized report may be obtained by addressing the Commission at 414 Walnut Street, Cincinnati 2, Ohio.

Gilbert Associates, Inc. Consolidates Offices in Reading, Pa.

The home office of Gilbert Associates, Inc., Reading, Pa., has recently been consolidated at 607 Washington Street of that city. Personnel, files, and equipment from five other offices scattered at other locations in the city have been transferred to the new location. Only personnel at 136 N. 6th Street will remain at that address.

"Hey YOU! Don'tya know you're right smack on our new line to the Waste Treatment Plant?"

Vacuum Desalting Device at Testing Stage

The United States Navy is about to test the efficiency of a new apparatus which extracts the salt from ocean water. The machine, an unorthodox type of still, was built in San Gabriel, Calif., by the inventor, Peter Jones, and his associate, O. F. Baumann.

Jones has applied for patents on an apparatus which will employ nature's miracle of boiling water with a vacuum instead of heat.

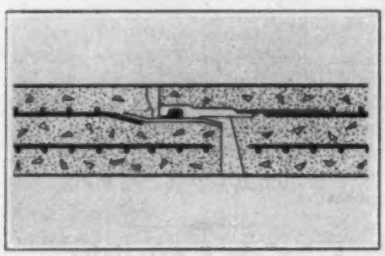
The principle is the same that causes water to boil at a much lower temperature on a mountain top than at sea level.

The machine Jones has completed under a Navy contract is a $50,000 pilot unit which contains only some of his original ideas.

"This pilot plant," Jones says, "doesn't represent my final plan. It is merely the first still in which I have been able to include some of my ideas. In San Gabriel we have been testing it on a large tank of brine with the aid of a diesel motor. It produces 250 gallons of distilled water per hour at a cost of eight cents. We'll know more about its ultimate possibilities when the Navy completes testing it closer to the ocean."

Roberts Filter Mfg. Co. Quarter Century Club Has 29 Members

The sixth annual banquet of the Quarter Century Club of the Roberts Filter Manufacturing Company, Darby, Pa., was held November 18, 1953, for employees who have served the Company for 25 or more years. One new member was admitted to the Club, making a total of 26 service and 3 honorary members. Carlisle H. Reville was elected President and Harold W. Pugh Secretary of the Club for the coming year.

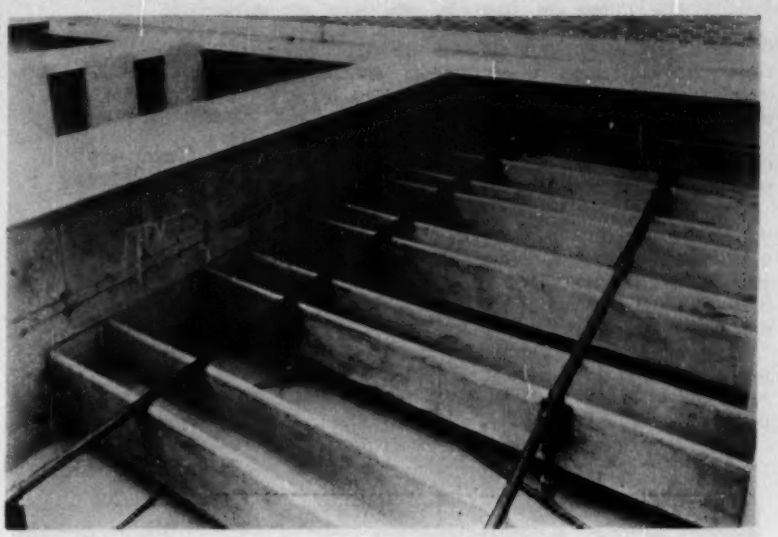


"Armored Joint" Pipe

101

Universal Concrete Pipe Co., Columbus, O. has announced that a special type joint, long-used successfully on pressure pipe, is now available on reinforced sewer pipe.

(*Continued on page* 102A)



6 Reasons why

PALMER SURFACE WASH SYSTEMS

are specified by water works engineers

1. **Prevent Sand Beds From Cracking.**
2. **Eliminate Mud Balls.**
3. **Save Wash Water.**
4. **Lengthen Filter Runs.**
5. **Higher Rates of Filtration.**
6. **Better Tasting Water.**

Write today for Bulletin 451 and a list of water purification plants that have gone modern.

STUART CORPORATION
516 N. CHARLES ST., BALTIMORE 1, MD.

Trade-marked "Armored Joint" the new pipe, combines steel joint rings and long-lasting rubber gaskets that insure against leakage or infiltration.

The rings, embedded in the concrete pipe wall, are welded to the pipe's steel reinforcement.

The rubber gasket is seated in a special groove in one ring so it is confined and protected. The complete joint is said to provide ample flexibility to allow for normal contraction, expansion and deflection.

The long length of Armored Joint pipe speeds and simplifies installation, even under the toughest laying conditions.

It can be made to conform to any standard specification for reinforced concrete pipe.

Neptune Meter Company Admits New Members to 25-Year Club

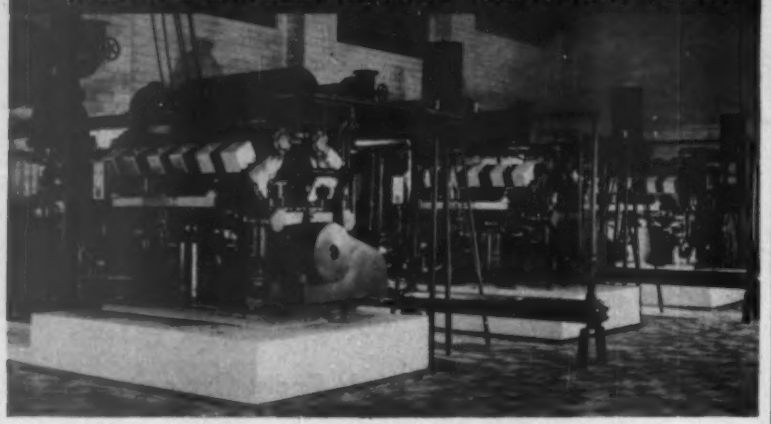
A total of 5,922 years of employment at Neptune Meter Co. was represented by 197 active members of Neptune's 25-Year Club attending the annual dinner at Hotel Astor, Dec. 4th, when twelve new members were admitted. Organized in 1936, the Club includes members from Neptune's plants in Long Island City, Toronto, Canada, and sales offices in all parts of the United States. New members receive a gold lapel pin in the form of a small water meter.

Michael J. Siebert, district sales representative in Richmond, Va., is president of the Club. Other officers are Arthur C. Reichardt, Bellerose, L.I., first vice-president; John J. Wilkeyson, Brooklyn, N.Y., 2nd vice-president; Anthony J. Petralia, Long Island City, secretary; Gustave Hinkel, Lynbrook, L.I., treasurer.

climax BLUE STREAK ENGINES

Provide Power In

VIRGINIA'S LARGEST SEWAGE TREATMENT PLANT



Three of the five Climax Sewage Gas Engines used at Roanoke, Virginia.

In the new Four Million Dollar Sewage Treatment Plant designed to treat wastes from a population of 140,000, five Climax Engines provide the dependable power.

Three Climax Model V-125, 12 cylinder sewage gas engines each rated 220 H.P. at 670 r.p.m. drive Roots-Connersville Blower equipment with a total capacity of 15,000 c.f.m. Two Worthington 12 MGD raw sewage pumps are driven by Climax V-80, 8 cylinder sewage gas engines rated 134 H.P. at 700 r.p.m.

Heat of the jacket water and exhaust gas is recovered and utilized for the digesters and building.

This plant was designed by Alvord, Burdick & Howson of Chicago, and construction was supervised by Mattern & Mattern of Roanoke.

climax

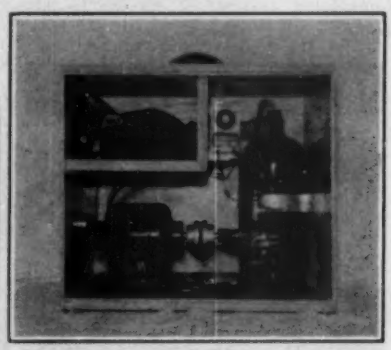
FOR COMPLETE INFORMATION, WRITE TO . . .

ENGINE AND PUMP MFG. CO.

208 So. La Salle St.

CHICAGO 4, ILLINOIS

Factory—Clinton, Ia. *District Office*—Dallas, Tex.



Automatic Effluent Sampler

102

Compact Air Samplers, Demarest, New Jersey, has developed an automatic effluent sampler designed for taking samples periodically from effluent streams, rivers, process lines, etc., for compositing and analysis. The sampler provides dependable service because the time cycle is more precise and the volume of each sample is accurately controlled. The only time required of personnel is that involved in changing receivers.

The sampler transfers controlled samples of liquid every 15 minutes into a large receiver. Once the instrument has been set up, it will continue to take samples in this manner until the electrical current is turned off. This continuous operation means uninterrupted sample collection for many days if necessary. Very little electric current is required for this low-cost sampler, as the pump operates for a total of only 30 minutes out of each 24 hours of operation.

O. A. DeCelle & Associates to Represent Atlas

The Atlas Mineral Products Co. Mertztown, Penna., has announced the appointment of O. A. DeCelle & Associates, 4900 West Madison St., Chicago, Illinois as its mid-western representative. Mr. DeCelle and associates will promote the sale of

(*Continued on page* 103A)

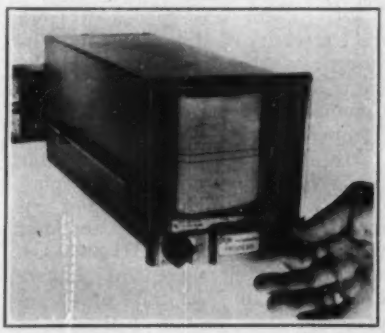
Atlas water and sewer jointing materials in southeastern Wisconsin, northern Illinois and Indiana. Mr. DeCelle's long years of association with the sale of hydraulic, mechanical and chemical materials and equipment will assure Atlas customers complete and competent service.

Neptune Meter Names Haendel Chicago Manager

Neptune Meter Co., New York, N.Y., has announced the appointment of William P. Haendel, formerly sales representative in Wisconsin, as district sales manager of the Chicago area.

Haendel succeeds H. B. Brown, who resigned the Chicago position due to illness, but remains on the Neptune staff. The Chicago district includes Illinois, Minnesota, Wisconsin, North and South Dakota, Michigan, and northern Indiana.

Haendel, a native of Milwaukee, has been in the water works equipment field for more than 30 years, including nearly 10 years in manufacturing as a plant superintendent.



Miniature Recorder Receives Four Variables

103

Fischer & Porter Company, Hatboro, Pa. has developed a new miniature recorder capable of receiving four variables, instead of the conventional three. Capable of housing a maximum of four simple pneumatic receivers, the instrument can record two variables and indicate two more

(*Continued on page* 104A)

THOROSEAL *Restored* this Filtration Plant

BEFORE

Example of complete break-down of masonry, due to penetration of water into body of concrete and action of frost in damp masonry.

It is amazing how THORO System products will correct a condition, such as shown in photograph. Concrete was sandblasted to remove all disintegrated material to sound concrete surface and reinforcing rods. Patching was done with THORITE Patching Mortar, bringing blistered areas to true and even lines, followed by two applications of WHITE THOROSEAL for protection.

AFTER

At minimum cost, almost ½ the cost of other methods, concrete restoration, patching and surface protection was completed with THORO System products on Filtration Plant in Keyser, West Virginia. Contractor: Standard Construction & Waterproofing Company, of Cumberland, Maryland.

WATERPLUG	THOROSEAL	QUICKSEAL
To Stop Leaks	To Seal Surface	For Beautiful Finish

Our 20-page Brochure describes, in detail, how The THORO System products can benefit you in your construction plan. Send for brochure today, which shows methods of application and how to use the material.

Standard Dry Wall Products

Box X, NEW EAGLE, PENNA.

or record three variables and indicate the fourth, as well as performing many simpler functions. Called the Ratographic recorder, it is suitable for standard, graphic or semi-graphic panel mounting.

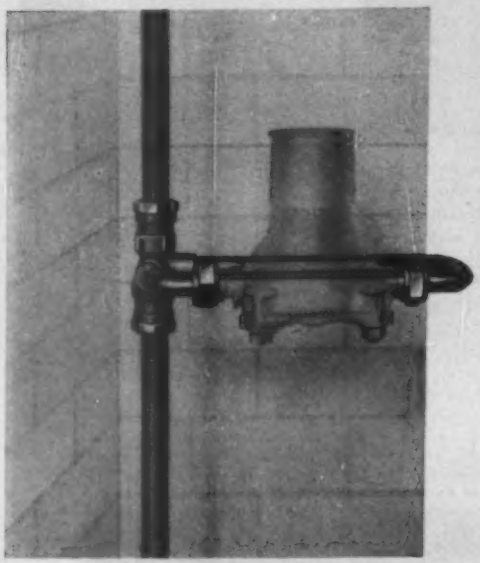
To transform the recorder into a recording-controller offering the advantages of a loading station, a standard F&P field-mounted pneumatic controller may be plugged into the back of the recorder chassis. Such a recording-controller unit might, for example, record signals from both a wild line and a controlled line and, in addition, indicate both set point signal and valve signal. A large external automatic - manual transfer knob and a set point knob allow easy adjustment and bumpless transfer. Furthermore, the set point indication, instead of being mechanically adjusted by the knob, is the result of a true pneumatic signal tapped from the set point pressure regulator pneumatic line to the controller.

Syncrogear With Explosion-Proof Motor

104

U. S. Electrical Motors, Inc., Los Angeles, Calif., has just announced a new right-angle Syncrogear with explosion-proof motor, for locations where dangerous fumes, inflammable gases, explosive substances or combustible dusts may exist. Available in 1 H.P. rating with speeds from 45 to 155 rpm, this 3-phase A. C. motor is known under this manufacturer's designation as Type SESV-GW. The explosion-proof motor is designed to comply with Underwriter's specifications for Class I—Group D, Class II —Groups F and G service.

The U. S. right-angle Syncrogear incorporates a cantilever design to protect gear alignment. Mounting stresses are absorbed by the one-piece base, freeing the gear and motor housing of distortion. Type SESV-GW embodies splash lubrication, a hardened and ground worm, normalized castings and asbestos-protected windings.



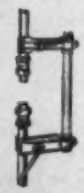
For Setting Meters in Basements

EASY TO INSTALL

The KORNERHORN

In a vertical basement pipe, against the wall or in a corner, the Kornerhorn makes a most satisfactory meter setting. Installation is fast and economical as pipe threading is eliminated. Send for detailed information.

1. Cut supply line. Clamp not necessary but convenient



2. Add Connections

3. Kornerhorn in place

When Valves are Needed

Ford Kornerhorn valves installed on the supply side, or on both sides of the Kornerhorn add extra convenience and cleanliness when meters are changed.

THE FORD METER BOX COMPANY, INC.

FOR BETTER WATER SERVICES

Wabash, Indiana

FORD

General Filter's Lawlor Elected Mayor of Ames

Joseph P. Lawlor, President of the General Filter Co. of Ames, Iowa, has been elected Mayor of the City of Ames. He has, at previous times, served as councilman for the City.

Mr. Lawlor was graduated from the University of Illinois in Civil Engineering, served as Captain in the U. S. Army of World War I and as Commander in the U. S. Navy Civil Engineers Corps, World War II.

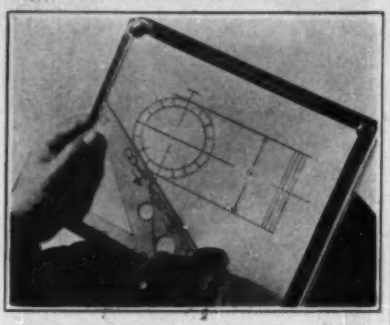
Mr. Lawlor became estimator for Layne & Bowler Co. of Memphis, in 1921. By 1922 he was chief engineer of Layne-Central Co. and later vice-president of Layne-Arkansas Co. and secretary-treasurer of Layne-Central Co. In 1930 he became vice-president and general manager of Layne-Chicago Co.

In 1935 Mr. Lawlor organized the General Filter Co. of Ames, Ia. and became its first and continuing president. During a period of shortage of teaching staff he served as Assistant Professor of Civil Engineering at Iowa State College, teaching Surveying, Sewage Treatment and Water Power Engineering.

Ames, a city of some 23,000, back in 1920 pioneered in the City Manager plan of government and has been under that form of government con-

tinuously since. The City Manager, a council of six members and the Mayor, administer the affairs of the city.

Mr. Lawlor's extensive contact with various city government problems, should serve him well in his political venture as Mayor of Ames.



Portable Drawing Board for Engineers

105

The Graphostat Company, East Orange, N.J., has developed a portable drawing board molded of clear polystyrene plastic that should prove itself extremely useful to engineers, draftsmen, contractors, architects, mechanical drawing students or anyone requiring a precision drawing, sketch or design.

Made of durable, transparent plastic it weighs less than 8 ounces and can be slipped into a briefcase. Four corner clamps for attaching 8½ x 11 paper assure smooth, sure handling of the working sheet without the use of thumbtacks or scotch tape. The clamps are recessed into the plastic so that a triangle or ruler can ride freely over them without interference. Two metal straight edges, one horizontal, one vertical, are retractable, thus making it possible to do precision work without the use of a T-Square. Tension clamps on the under side of the board provide for secure storage of triangles. The board measures 9¾ x 12¼ inches.

Foxboro Establishes a New Branch in Amarillo

The Foxboro Company, Foxboro, Mass., has announced the opening of a branch office in Amarillo, Texas. Located at 1117 La Paloma Street, the new branch was made necessary by expanded industrial activity in the region.

Assigned to the office as Industrial Engineer is Mr. D. T. McElligott, a graduate of Texas Technological College with a degree in Electrical Engineering. Mr. McElligott, formerly with the Foxboro office in Dallas, will serve instrument users in parts of Oklahoma and New Mexico, in addition to the Amarillo area.

Pipe Enamel Quantity Calculator and Slide Rule

106

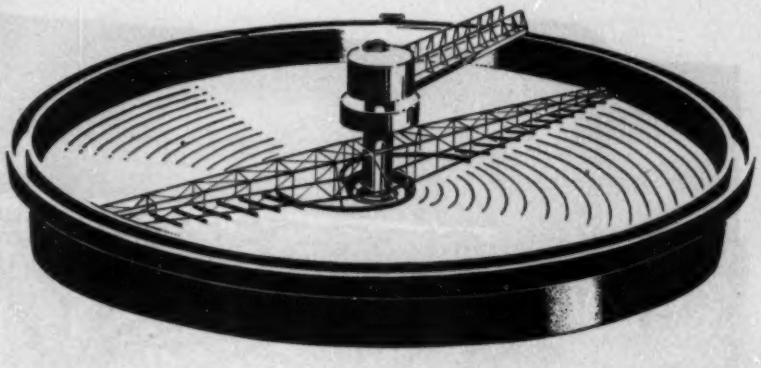
Reilly Tar & Chemical Corporation, Indianapolis, Indiana, has produced a new revised coal tar base enamel quantity calculator.

The calculator gives estimates for quantities of enamel required in pounds per thousand feet and gallons per mile on two grades of Primer. It also gives estimates for coupling compounds required for mechanical couplings on pipe of normal size from 2" through 48". Tables of recommended temperatures of application for enamel are given and estimates for drying time on Primer are tabulated.

Information on quantities required for hand application of coal tar base enamels to irregularly-shaped engineering structures is given.

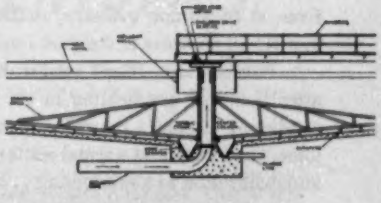
On the reverse side of the calculator, a Mannheim type slide rule is available for multiplication, division, etc., covering the calculations needed to estimate the total amount of material required on any pipeline coat-

(Continued on page 106A)



Center-Feed
Center-Discharge
Clarifiers

One reason for the efficiency of Hardinge Clarifiers is the fact that the influent goes directly to a central stilling well and the underflow also is centrally removed. This promotes quick disposal of the heavier solids immediately upon entry—makes less work for the rotating sludge scrapers. The clear effluent overflows the tank periphery, where velocity is at a minimum. Bulletin 35-C-15.



HARDINGE
COMPANY, INCORPORATED
YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works
New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco

ing job. The slide rule has C, D, CF, DF, A, and B scales, and is provided with a plastic hairline slide.

Fischer & Porter Offers Engineering Facilities for Special Instrumentation Development

Fischer & Porter Company, Hatboro, Pa., has announced the creation of the Special Products Division for development of special instruments and instrument components to contract specifications, as the latest step in its planned program for expanding its service to industry. Mr. Edward H. Muhleisen, who has served both as field engineer and applications engineer for Fischer & Porter, has been appointed manager of the new division.

The company's sixteen years of experience in the design and development of instrumentation for broad industrial use is now made available for solution of highly specialized instrumentation problems. Special projects will be handled to develop instrumentation for difficult applications relating to point-of-measurement or remote indication, recording, and/or control of such variables as flow, pressure, temperature, level, specific gravity, viscosity, consistency, and others.

JC-60 SEWER JOINTS

. . . actually turn roots away

An ordinary root may exert pressure as high as 50 psi at the tip. Thus, it is easy to understand why roots are a common cause of sewer line destruction . . . and why foresighted engineers specify ATLAS JC-60®, the synthetic plastic base, *root resistant* jointing compound.

Roots cannot penetrate the surface of a JC-60 joint. JC-60 is hard . . . so hard it forces roots to change direction. At the same time, *high adhesion of JC-60 prevents roots from entering between the pipe and the compound.* Even at maximum pressure, ordinary roots cannot break the tight bond that JC-60 provides at the joint interfaces.

Furthermore, JC-60 *retains* this combination of characteristics. Even after hours of overheating in the melting pot or pouring under adverse conditions, properly poured ATLAS JC-60 still provides tight, root-proof joints that withstand normal settling without failure . . . reduce infiltration and exfiltration to a minimum . . . resist chemical and bacterial attack.

FOR COMPLETE FACTS . . . Send for Bulletin M20-3.

ATLAS JOINTING COMPOUNDS
. . . a permanent bond

OTHER ATLAS PIPE JOINTING MATERIALS
Include GK® *and* SLIPJOINT GK® *for sewers . . .* MINERALEAD® *and* HYDRORINGS® *for cast iron water pipe.*

ATLAS MINERAL
MERTZTOWN, PENNSYLVANIA

Engineering Representatives Throughout the United States

Dust Hood Protects Eyes, Head, Face and Neck

107

General Scientific Equipment Co., Philadelphia, Pa. has available a dust hood that is light weight, easy to wear, and weighs only 5 oz. This comfortable, roomy hood keeps the worker under cover in those places where nuisance or irritating dusts are present.

Made of light weight cloth, with a large picture window, offers full unrestricted vision in all directions. May be worn with a Respirator.

Eastling Appointed General Manager of Link-Belt Pacific Div.

Link-Belt Company, Chicago, Ill., has announced the appointment of Harvey V. Eastling as general manager of the company's Pacific Division, with headquarters in San Francisco. He succeeds Ralph M. Hoffman, who is retiring after 40 years of service.

The Pacific Division has plants in San Francisco, Los Angeles and Seattle and district offices and fac-

tory branch stores in those cities and in Portland, Spokane, Oakland and Salt Lake City.

Mr. Eastling, who has been assistant general manager of the Link-Belt Pacific Division since June 1, started his Link-Belt career in 1925 as chief draftsman at the San Francisco plant.

He later became chief engineer of Link-Belt Company Pacific Division and subsequently manager of engineering sales in Seattle. In 1940 he was appointed general sales manager of the Pacific Division.

Mr. Hoffman joined the predecessor of Link-Belt Company Pacific Division, Meese & Gottfried Company, in 1913. He became president of Link-Belt Company Pacific Division in 1943, and in 1948 was elected a vice president of Link-Belt Company. He is retiring in accordance with the Link-Belt retirement plan.

Marlow Changes Sales Representatives

Marlow Pumps, Ridgewood, New Jersey, announces the appointment of Mr. William Maxwell, as Sales Engineer for the Company's New England Territory. Mr. Maxwell succeeds Mr. William Van Blarcom, who was recently made General Manager of Marlow's De Queen, Arkansas Plant.

Mr. Maxwell, an engineering graduate of Massachusetts Institute of Technology, has had previous pump application and sales engineering experience with both the Blackmer Pump Company, and Fairbanks Morse. His headquarters will be in Natick, Massachusetts.

Compression Pipe Couplings

108

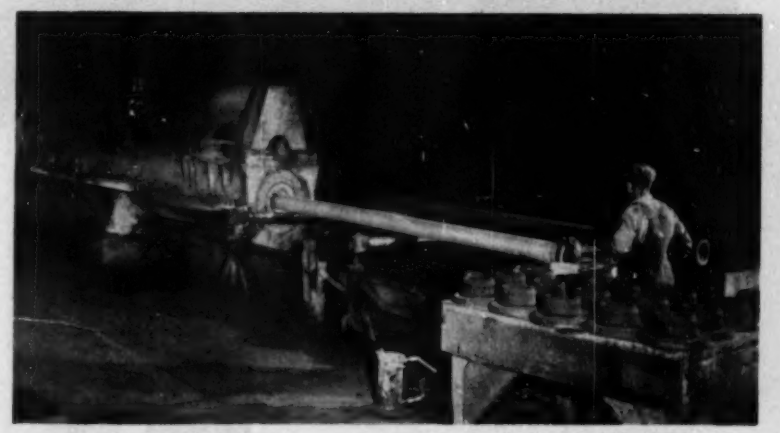
Morris Coupling and Clamp Co. has just released a folder on **Compression Pipe Couplings.** The folder explains the use of the coupling on cast-iron, steel and asbestos-cement pipe—threaded or mechanical joint. It also identifies components of manufacturer and applications common to public works, industry, and commerce. Photo legend showing speedy method of on-the-job assembly and information on prices, sizes and other specifications is included.

Rodney Hunt Appoints W. C. Davis & Associates Agent for Southeastern States

Rodney Hunt Machine Co., Orange, Mass., has announced that W. C. Davis & Associates, Alanta, Georgia, has been appointed agent in the Southeast for the company's Process Equipment Division. Headed by Mr. Walter C. Davis, the organization will have complete sales engineering and marketing responsibility for the patented Rodney Hunt Turba-Film Evaporator and the Rodney Hunt-Luwa Spray Dryer, as well as other stainless steel processing equipment.

Mr. Davis has had more than 15 years of experience in chemical and allied industries following his graduation from the University of Tennessee with a degree in chemical engineering. At various times he has been associated with du Pont, Allied Chemical & Dye, American Machine and Metals, and Sharples Corporation. At Sharples, Mr. Davis served as manager of the process engineering department.

PIG IRON *with a* HOLE IN IT!



Close-up view of pulling a pipe from centrifugal casting machine.

WHY McWANE-PACIFIC CAST IRON PIPE LASTS for CENTURIES

Cast Iron Pipe is an engineering product. But the "wag" who jokingly said that Cast Iron Pipe was a "chunk of pig iron with a hole in it" probably spoke with more wisdom than he realized.

Production of pig iron is the first step in refinement of iron ore. As everyone knows, iron ore has laid in the ground for untold ages of time, without rust or corrosion. The more iron is refined, the more subject it is to rust and deterioration. The less it is refined, the more durable it remains. That is why McWane-Pacific Super DeLavaud cast iron pipe, ("pig iron with a hole in it") lasts for centuries.

For details, wire or write McWANE CAST IRON PIPE COMPANY, Birmingham, Alabama, or PACIFIC STATES CAST IRON PIPE COMPANY, Provo, Utah. (Sales offices in principal cities.)

McWANE PACIFIC PIPE *Lasts for Centuries*

Kansas City Manager Named by Worthington

Worthington Corporation, Harrison, N. J., has announced that Mr. John R. Hamill has been appointed Manager of the Kansas City District Office of the Company. He will succeed Mr. Paul J. Foley who has been appointed General Sales Manager for Worthington's Plainfield (N.J.) Works' products.

Mr. Hamill joined Worthington in 1937 after graduating from Northwestern University. After assignments as Estimator in the Oil Field Product Division at Harrison and Sales Engineer attached to the Buffalo (N.Y.) Works, he was appointed, in 1944, Gulf Coast Manager of the company's Marine Division. From 1950 until the present, he has served as Manager of Worthington's Wilmington Branch Office.

Portable Engine-Generator

109

The Wincharger Corporation, Sioux City, Iowa, has stepped up the continuous operating capacity of their portable Engine-Generator, Model F4500, from 2,500 watts to 3,000 watts. This unit has a motor-starting capacity of 4,500 watts.

Wincharger's new "F" Series Winco Engine-Generator includes a number of other features that are of considerable interest.

The "belted" feature, for example, permits the user to run the engine at the engine-manufacturer's best recommended speed and the Winco generator at 3,600 rpm. The Wincharger Corporation feels this provides maximum engine life, and greater smoothness and steadiness of output. Also, if the engine needs servicing, it can be easily removed and sent in for repair without sending in the generator with it.

By means of a universal mounting base, the user can specify either a Briggs & Stratton or Wisconsin engine with his Winco Generator, or buy it without engine and mount an engine he might have already.

HYDRAULICALLY OPERATED VALVES

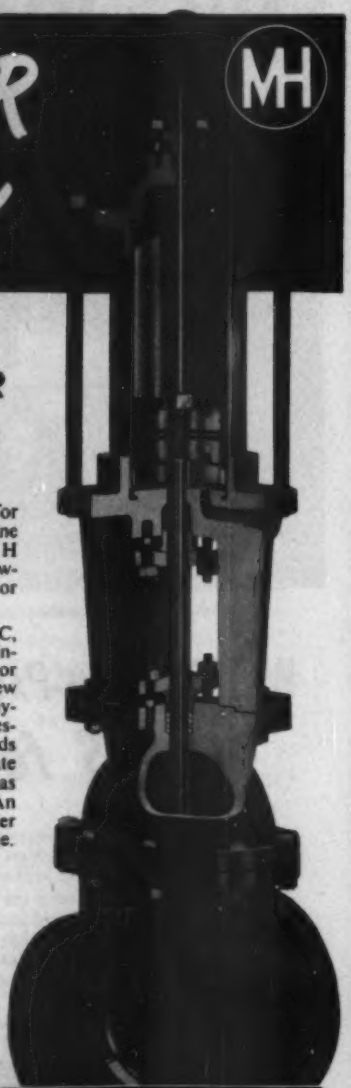
Put WATER To WORK

MH

SEAMLESS BRASS CYLINDER OR BRASS LINED

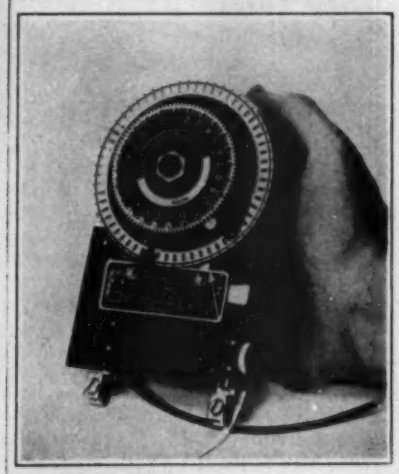
For frequent operation, remote control or for inaccessible valves, you may use your pipe line water pressure for opening and closing M & H hydraulically operated valves. If desired, however, cylinders operate equally well using oil or air pressure.

All M & H Gate Valves, Classes A, B and C, may be ordered equipped with hydraulic cylinders—brass tube cylinders as illustrated, or brass-lined cast iron cylinders. Outside screw and yoke can be installed to operate the hydraulic valve manually in event operating pressure fails. A bronze tail rod which extends through the top of the cylinder cover to indicate the position of the gates may also be used as a pull rod to operate the gate, if necessary. An adjustable stop may be installed on the cylinder cover to control the degree of opening of the gate.



The size of the cylinder depends on the size of the valve, water pressure available for hydraulic operation, and water pressure against the gates. For complete information, write or wire M & H VALVE AND FITTINGS COMPANY, Anniston, Alabama.

M&H PRODUCTS FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION



Combination Dial for Automatic Short Operation Control

110

Tork Clock Company, Inc, Mount Vernon, N.Y., has announced a new combination dial for time-switches, making possible automatic short-operation control in sewage disposal plants, hot gas defrosting, stock feeders, and other industries.

The new Tork dial (patent applied for) makes it possible for automatic time-switches to control both long and short operations with the use of only one dial. 24-hour dials presently in use on timers move only 3/1000 of an inch per minute, and cannot control operations of less than 15 minute duration. In order to control both long and short operations, present models require the addition of a min-

ute dial, greatly increasing both unit size and cost.

The combination dial developed by Tork consists of a 24-hour dial mounted on a 60-minute dial. Simple pin settings permit the automatic control of operations from 1 to 55 minutes, at every or any hour of the day.

For example, if a 12 minute operation is required five times a day, at 7:00 p.m., 8:00 p.m., 9 p.m., 9:00 a.m., and 10:00 a.m., pin trippers are inserted into the holes at those hours on the 24-hour portion of the dial. These pin strip the switch into the ON position by activating the swinging lever set in the "O" position on the outside 60 minute dial, and the time-switch automatically starts the operation at these hours. The OFF lever tripper is set at the 12 minute mark on the minute dial, and automatically turns the switch OFF at the required time, stopping the operation.

Action is automatic and continuous, and once set, the switch requires no further adjustment unless it is required to change time cycles. A manual lever, for ON and OFF hand operation without disturbing the master cycle, is built in.

Charles M. Barry

Worthington-Gamon Names New England Representative

Worthington-Gamon Meter Division of Worthington Corporation, Newark, N. J., has announced that Mr. Charles M. Barry has been appointed New England District Representative. He will assist the District Manager in the sales of W-G's liquid meters in the New England territory.

Mr. Barry had been associated with the city of Winthrop, Mass. for the past fifteen years.

Rockwell Names Sales Engineer for East Texas

Rockwell Manufacturing Co., Pittsburgh, Pa., has announced that J. N. Holland of 1802 Branard St., Houston, Texas, has been appointed a sales engineer for the Meter and Valve Division, covering most of East Texas.

Mr. Holland will take over much of the territory formerly handled by Kenneth Rembert, a change made in order to allow Mr. Rembert to spend additional time in the Port Arthur-Beaumont-Lake Charles area.

A 1951 graduate of Texas A & M College with a B.S. degree in industrial engineering, Mr. Holland joined Rockwell last April as a sales trainee.

From June, 1951, to March, 1953, he served with the U.S. Air Force at Sheppard Air Force Base, Wichita Falls, Texas.

New Universal Trencher

Heller Engineering & Manufacturing Company, Lynwood, California, has developed a new Universal Trencher designed for mounting on the Oliver "OC-3" Crawler Tractor. Some features include four-foot depth of excavation, digging width control with bolt on clearance teeth, six digging speeds, adjustable and reversible soil conveyor, hydraulic control for fingertip operation, safety clutch and hydraulically-controlled backfiller blade. The Trencher mounts upon the Oliver Tractor with perfect balance and the side mount for the

(Continued on page 110A)

NO OTHER PIPE JOINT Can Equal BOND-O

- *In First Cost*
- *In Uniformity*
- *In Performance*

A careful survey of pipe joint costs will surprise you as to how much you can save with BOND-O. The low installation cost as well as a perfect performance record proves that nothing else equals BOND-O.

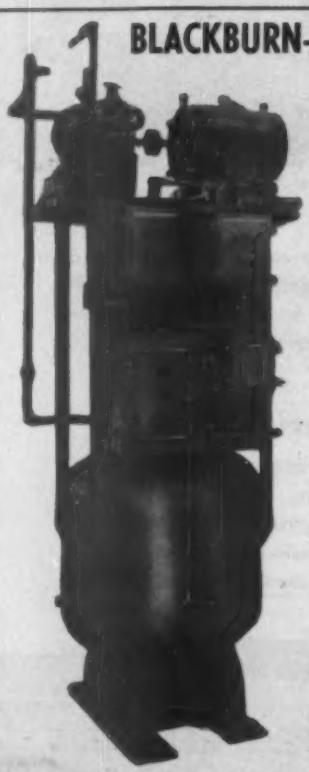
This self-caulking compound is accurately formulated and is used for jointing cast iron bell and spigot pipe.

Machine-blended by a unique process, BOND-O makes joints that are uniform and trouble-free. No BOND-O failure has ever been reported.

Write for literature today.

NORTHROP & COMPANY, INC.
SPRING VALLEY, N. Y.

BLACKBURN-SMITH SEWAGE EJECTORS



RATED TO HANDLE

12,000 GPM OF SEWAGE

WERE FURNISHED IN 1952 ALONE

The above figure represents the rated amount of sewage handled by Blackburn-Smith ejectors in one year alone, attesting to the wide usage and desirability of a good, dependable, rugged pneumatic sewage ejection system.

30 to 500 GPM in both single and twin units against high discharge heads.

Exclusive Modern Features

Over 50 years service has proved the worth of Blackburn-Smith Ejectors. Yet our today's product is full of exclusive modern features such as:

1. Float and electrical float switch controls.
2. Float and pneumatically controlled snap action valve.
3. Electrode controls.

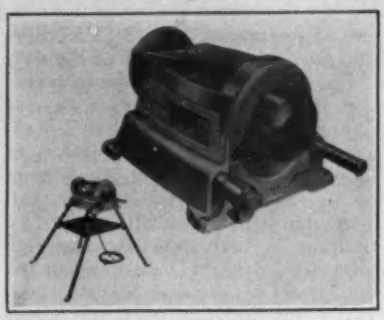
Any one of the above, with or without Air Receivers. Get Catalog S.

Compact ejector system having motor compressor assembly and all controls in one "packaged" unit.

Blackburn-Smith Mfg. Co. Inc.

98 River St., Hoboken, N. J.
Phones: HOboken 3-4425
REctor 2-9360

operator with his controls readily at hand assure perfect operator vision and straight-line trenches without operator fatigue.



Power Drive Operates Hand Pipe Tools

112

Toledo Pipe Threading Machine Co., Toledo, Ohio, has announced the new Toledo 88 Power Drive, designed for fast efficient operation of hand pipe threaders, cutters and reamers.

Aluminum housing results in weight reduction to 140 lb., and increases ease of portability of this ruggedly constructed compact unit. It converts hand tools to power in the shop or on the job anywhere. Capacity—⅛" to 2" pipe, ¼" to 1½" bolts; with universal drive shaft, geared die stocks and cutters up to 12".

The Toledo "88" is attractive and modern in appearance with handsome red and gray finish. Advanced features contributing to powerful, speedy and efficient operation include: New Toledo 3-jaw scroll chuck on front with 6 pinions for greater convenience; rear chuck, universal centering. Universal motor, ½ hp., forward and reverse, 25 to 60 cycle, AC or DC, any 110 volt light socket. Reducing gears sealed. Only occasional lubrication required for steel-backed bronze bushings on spindle and spindle gear and drive pinion. Safety latch on tool-rest bar on left side. Recessed switch, protected against bumps. Positive chuck wrench ejector, each side. Chuck wrench in rubber holder when not in use. Protective plate guards motor and gearing from damage. Aluminum housing is one piece for added strength. Can be mounted on bench or service truck or furnished with set of legs and tool tray as accessories.

Sterling Moves Cincinnati Office and Appoints Curd Manager

Sterling Electric Motors, Inc., Los Angeles, Calif., has announced the appointment of a new District Office

NEW!
ARDCO
FOR *RAPID*
POLAROGRAPHIC
ANALYSIS

- Compact
- Portable
- Easy-to-Operate

MOD. 535
270.00

Cut down time and save operating costs on your disposal plant! Use the new Ardco for D O determination and oxygen utilization rates for the most efficiency. The new Ardco Model 535 is battery operated, making it completely portable and ideally suited for laboratory and field work. It will measure any ion capable of being reduced. With a few minutes instruction, anyone can operate it. Knob controls permit the selection of working voltages up to 3 volts and current multiplications to 24 micro amperes. Write for complete information.

GENERAL
LABORATORY SUPPLY COMPANY

Manager and a change of location for the company's Cincinnati, Ohio office.

Mr. John F. Curd has been appointed District Manager and the sales office has been moved to 2904 Woodburn Ave., Cincinnati 6, Ohio.

Mr. Curd brings to Sterling a fine and varied background in the electrical field. Graduated from the University of Kentucky, with a degree in Electrical Engineering, and after three years service in the United States Army in World War II, he began his career in this field by employment with Haggard Electric Company as Construction Engineer & Superintendent. He then was head of the electrical department for the J. H. Day Company, Inc. Prior to coming to Sterling he was employed by the General Electric Company, in Evendale, Ohio as an Electrical Supervisor.

Literature & Catalogs

Chemicals Used in Water, Waste and Sewage Treatment

113

Wallace & Tiernan, Newark, N.J., has available a chart giving information on the form, weight, solubility, strength, and use of common **Chemicals Used in Water, Sewage and Waste Treatment.**

The chart also includes data on the materials which can be used for handling each chemical in either its dry or solution form. This provides an aid in the selection of chemical feeding equipment, solution tanks and piping.

Water and Sand Separator

114

McCurdy Sand & Water Separator Co., Los Angeles, Calif., has available a specification sheet on the **McCurdy Water and Sand Separator.**

The specification sheet shows a cutaway, phantom drawing of the separator along with the descriptive text. The back page shows photographs of representative installations.

Lubrication Bulletin for Electric Motors

115

U. S. Electrical Motors Inc., Los Angeles, Calif., has just published a bulletin entitled **"U. S. Motors with Lubriflush"** that compares the vari-

(*Continued on page* 112A)

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ous methods of lubricating electric motors.

The bulletin illustrates the three principal types of bearings used in motors—cartridge, standard open, and Lubriflush types—with explanations of the function of each. For demonstrating the action of re-lubrication in the Lubriflush bearings, a series of naural color photos of a transparent bearing housing is reproduced. Proof that any motor bearing breathes air and therefore leads to contamination of the bearing is demonstrated photographically, to indicate the necessity of lubrication every year or so. Excerpts of statements by bearing manufacturers about the necessity of motor lubrication are presented.

A Few Facts About Darling Valve

116

Darling Valve & Manufacturing Co., Williamsport, Pa., has available a booklet giving **A Few Facts About Darling Valve & Manufacturing Co.** According to the booklet the company was founded in 1888 as the Darling Pump & Mfg. Co. Ltd., and was organized to manufacture and sell "Darling" oil well pumps and supplies and engage in the business of general brass founding and machining.

In 1894, a new plant was built and the entire operation moved to its present location in Williamsport, Pa.

Having been born into the rapidly developing petroleum industry, the Company's product line was soon expanded to include gate valves, for well control, flow-line and pipe-line use, and about the turn of the century, gate valves, and fire hydrants, were added. During the early 1900's the Company experimented and developed the original composition valve cup for oil well pumping equipment. Known as "Darcova" this trade name has since become a generic term.

Upon the death of one of the founders in 1917, the Company was incorporated as the Darling Valve & Manufacturing Co., Inc.

Darling operates a well integrated plant, comprising wood and metal pattern shops, iron and brass foundries, tool room, machine shop and assembly department. A complete and well equipped research laboratory in charge of skilled technicians is constantly at work on product and service-life improvements.

In recent years, the Company's product line has been expanded to include cast and forged steel valves,

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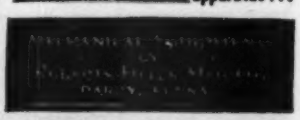

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bronze and special alloy gate valves and high grade specialties.

During World War II, Darling pipe line gate valves were used on both the "Big Inch" and "Little Inch" pipe lines, which carried vital crude oil and refined products to the Eastern seaboard from Texas.

Today Darling pipe line valves play an important part in oil and gas transmission lines throughout the world. Darling valves and hydrants enjoy a deserved reputation in the field of water supply.

During the past two years, Darling has introduced the "B-50-B" ball-bearing top hydrant, which represents the greatest single improvement in design since the introduction of the original Darling fire hydrant some 50 years ago.

Elliptical Venturi Tube

117

Simplex Valve & Meter Company, Philadelphia, Pa., has just prepared a new 5-page brochure to describe the **Type VE Venturi Tube.** This unit is a primary device used to produce pressure differentials from flowing liquids for the purpose of actuating rate of flow meters. The tube has a circular inlet and outlet but is constructed with an elliptical, in place of the conventional circular, throat design.

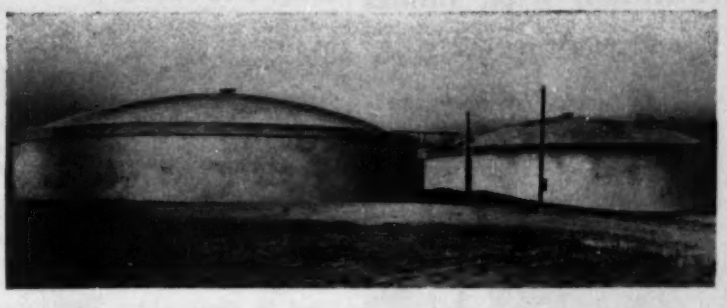
Data is given as to how any low-velocity, low-pressure flow of liquids, containing solids, can be measured in connection with a venturi meter. The tube is available for pipe lines measuring 12 to 84 inches in diameter with larger sizes to specification. Operation is standard at 125 or 250 pounds pressure. The tube may be made of all cast iron construction or with steel plate inlet and recovery cones attached to a cast iron throat section.

Emergency Electric Power

118

Homelite Corporation, Port Chester, New York, has just published a new 4-page, 2-color catalog-in-brief that describes and pictures Homelite carryable generators designed to supply **Emergency Electric Power** when storms, fires, floods or accidents disrupt normal power supply.

The new catalog explains the various functions and uses of these compact, lightweight, gasoline-engine-driven generators for industry, homes, utilities, etc. The booklet also includes a section on specifications, electric output, and prices of the five most popular models.



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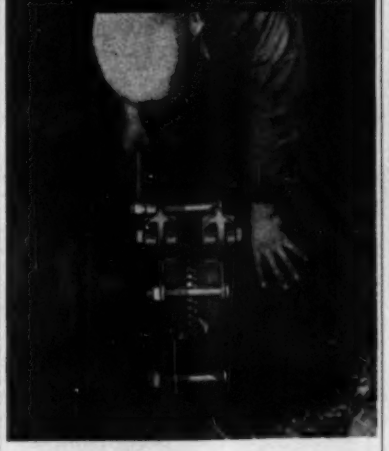

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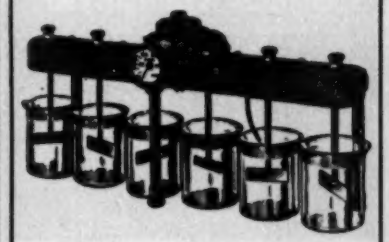

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119

Hercules Powder Company, Wilmington, Delaware, has published a booklet **"Protection With Parlon"**, that includes 35 case histories of the successful use of protective coatings based on chlorinated rubber.

Water and sewage works, paper mills, storage tanks, and chemical and food processing plants are among the installations located from coast to coast where Parlon-based coatings have been photographed after long-term exposure to a variety of corrosive environments. Also included in the 20-page booklet are performance data on Parlon finishes and instructions for applying Parlon paints by brush or spray to metal, wood, and various cement and asphalt surfaces.

Single Stage Turbine

120

De Laval Steam Turbine Company, Trenton, N.J., has just published a six-page bulletin containing design features, dimensions and performance data on the new **De Laval HCB Single Stage Turbine.** The De Laval HCB single stage turbine was designed for a variety of plant applications and can be ordered from stock for immediate delivery.

Maximum operating conditions of the HCB turbine are: hp to 100, pressures to 300 psig, temp. to 550F,

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speed to 4000. The bulletin presents a two-page cut-away diagram of the HCB turbine with a descriptive list of 18 design features.

Length and width measurements and dimensions of parts are given in line drawings of the HCB turbine. Other information includes performance data and construction materials.

Engineering Drawings of Flocculation Equipment

121

Stuart Corporation, Baltimore, Maryland, has available a series of engineering drawings on **Walking Beam Flocculation Equipment.**

The folder contains 9 complete drawings of walking beam installations in various parts of the country and operating instructions.

Froth Flotation

122

Denver Equipment Co., Denver, Colorado, has just published a bulletin on **Froth Flotation, Industrial and Chemical Application.**

The bulletin mentions examples of separating near-collodial size particles from a saturated brine; fractionation of fine clays; recovery of fossil resin from coal; water purification; and correcting stream pollution. Suggested briefly as potential uses for flotation are the recovery of cannery wastes; oils and greases from machine operations and meat packing plants; steel and petroleum refining process wastes; dairy wastes; fiber wastes from paper mills and cloth finishing plants; distillery wastes; complex wastes from organic chemical processes; purification of industrial waste waters and sludge; and lowering the BOD of waste liquors.

Maintenance of Control Equipment

123

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has published a new eight-page manual entitled **"Proper Maintenance of Control."**

Besides giving helpful suggestions toward overcoming some of the most frequent difficulties common to most electrical control devices, the pamphlet has a handy control trouble-shooting chart for quick reference showing the symptom, possible cause and cure.

The back page of the manual carries a listing of 26 suggested points for checking to assure satisfactory preventive maintenance of control equipment.

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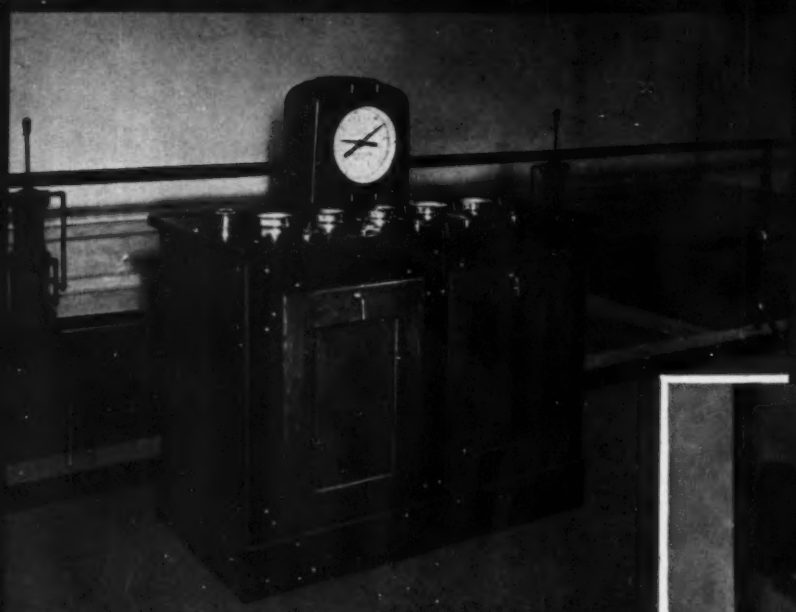

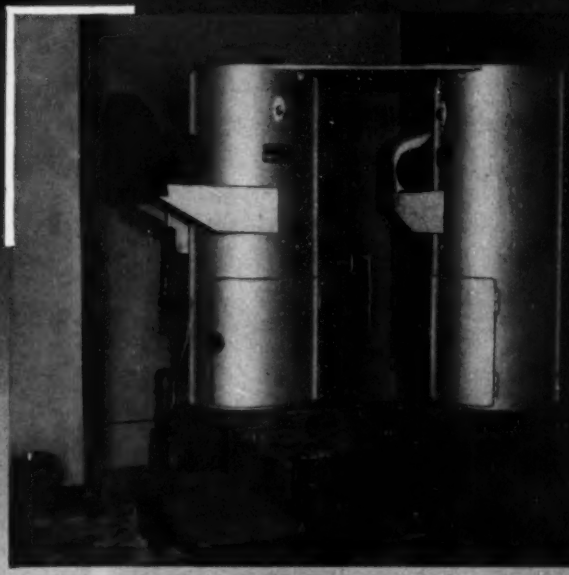

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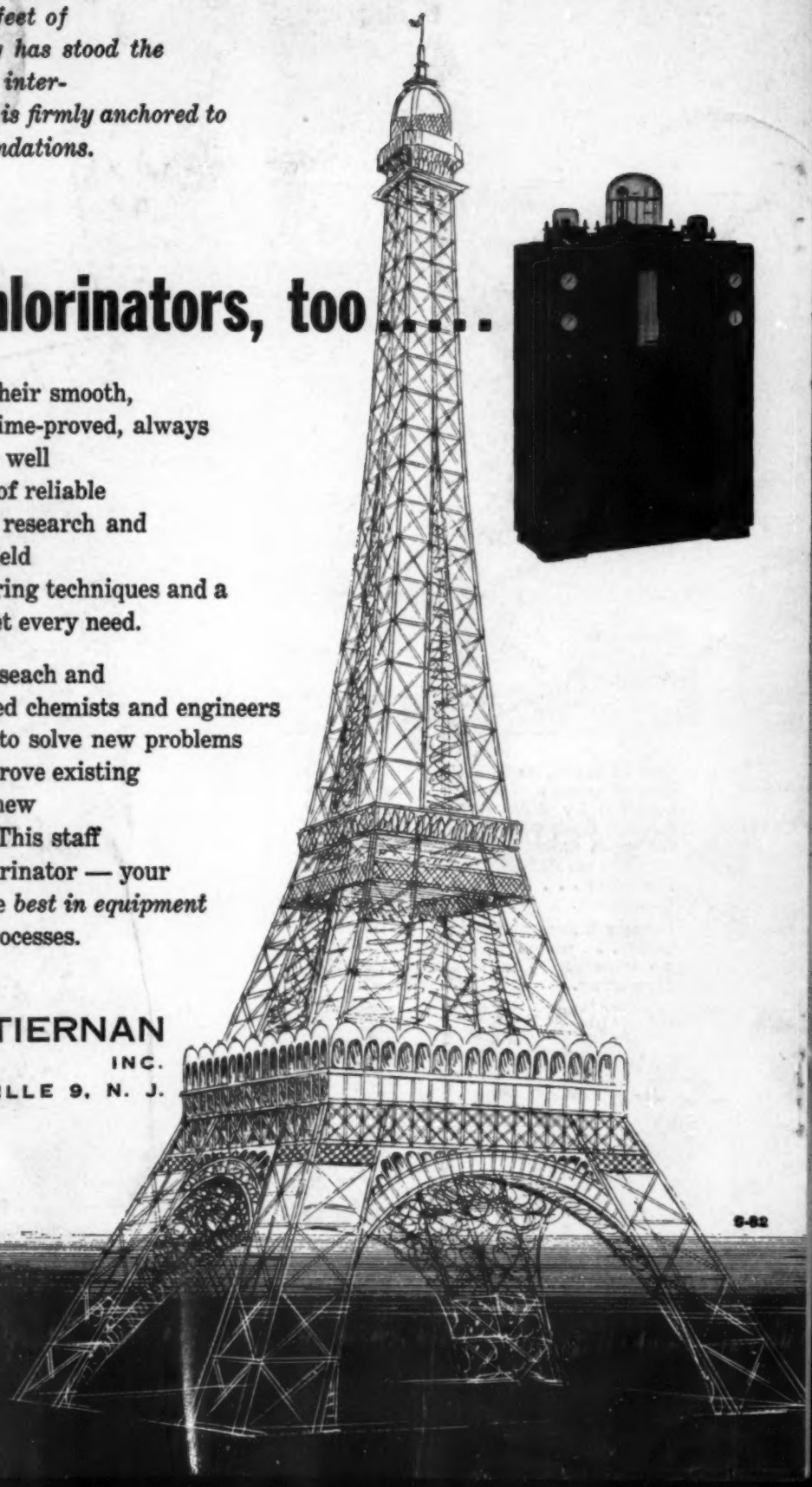

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